

Current Science



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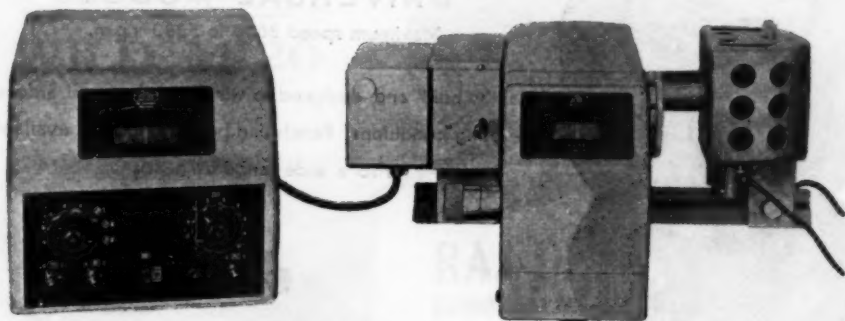
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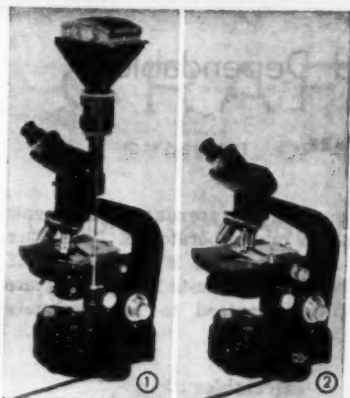
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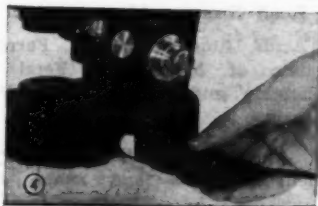
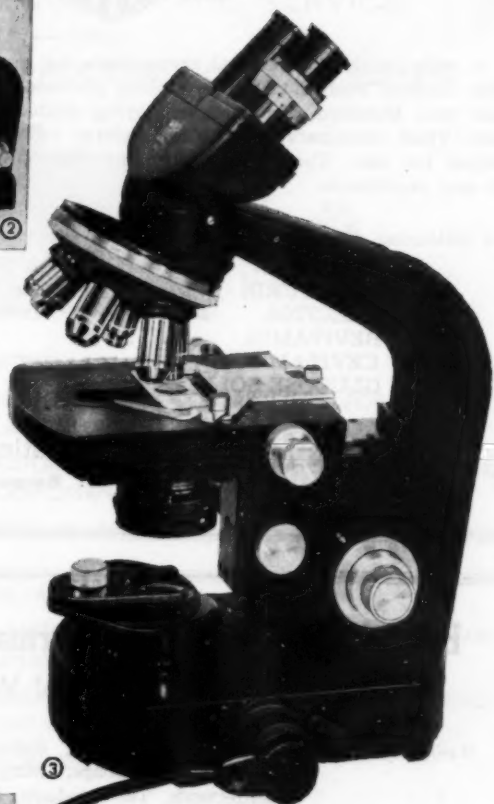


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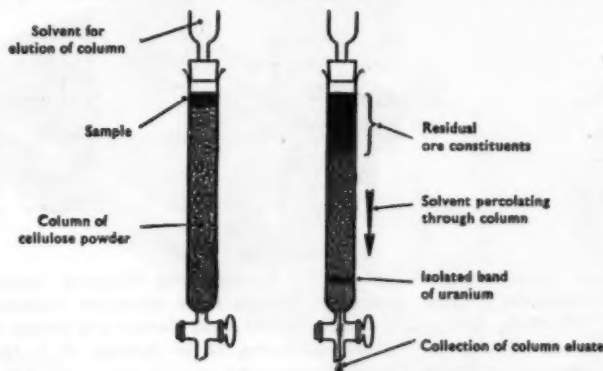
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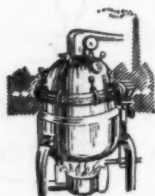
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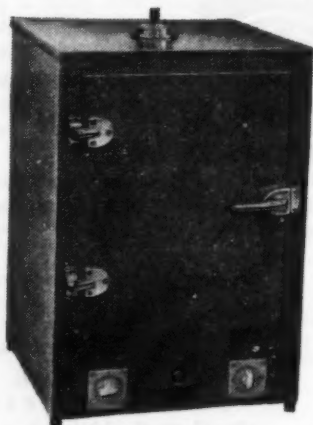
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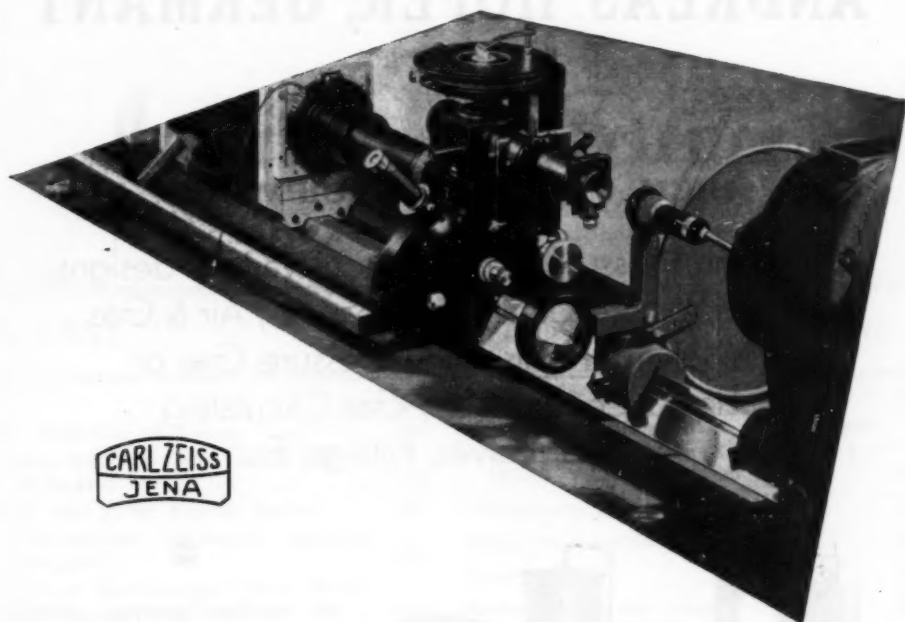


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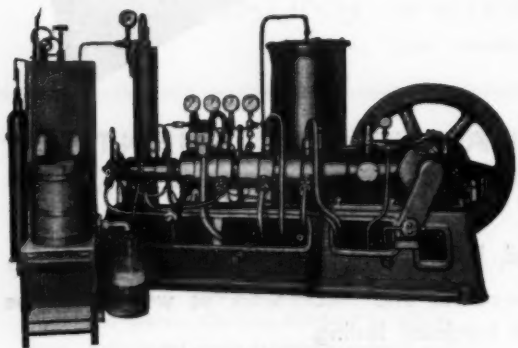
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WORLD RESOURCES OF ENERGY*

THE population of the world has been steadily increasing, while the consumption of energy is also rising in every country consequent on the insistence on higher standards of living. If the present trends are to continue, it is clear that the demand for more power should be met from fresh sources of power. These considerations formed the background for the discussions of the Fifth World Power Conference held in Vienna in June this year. The projects put forward at the meeting were in fact promises for raising the standard of living everywhere.

Reviewing the availability of energy from natural resources such as coal, oil, water power, the Conference felt that while there are large resources of all these resources in the world, they are by no means limitless. Coal, for instance, is in short supply in many countries. Actual supplies of coal within the earth are still plentiful, but most of it lies too deep below the surface to be mined economically. Also, the demand is increasing rapidly, and the time will come when we can no longer afford to use

coal except for some specific purposes such as the manufacture of medicine, synthetic food, and a few others.

It has been estimated that in 1953, 56.2% of the gross energy produced in the world was derived from pit and brown coal. Petroleum and natural gas contributed 42% of world power, and energy derived from hydropower stations amounted to 1.8%. By 1975, however, the energy demands of the world will have increased three-and-a-half times, and in the year 2000, eight times as much energy will be needed. It is impossible to increase production of energy to this extent from the current resources. As needs expand, the amount of coal and oil available will decrease. The only other natural source of power which can be exploited still further seems to be energy from rivers and lakes, and several projects for gigantic water-power installations are envisaged in various parts of the world.

China, for example, is engaged in harnessing one of the mightiest waterways of her country, the Yellow River. The project, described during the World Power Conference, involves the construction of 46 dams which

* With acknowledgment to UNESCO Features.

will prevent the disastrous floods experienced in the past and will produce 110 billion kilowatt-hours of electricity each year—some 35% more than the annual consumption of the highly industrialized Federal Republic of Germany.

Perhaps the greatest reserve of water power is hidden high in the Himalayan mountains, in the very heart of Tibet. It was pointed out that by building a tunnel ten miles long and diverting the Tsangpo River through it, a giant waterfall 6,480 feet high could be created. Once harnessed, its potential energy would be sufficient to produce 150 to 330 billion kilowatt-hours of electrical energy per year. This power would not only benefit the population of Tibet, but could also serve the aluminium industry of Assam and Bengal. With this additional energy, the industry would be capable of producing each year five times as much aluminium as the whole world produces to-day.

Even if such major schemes were realized, however, it would not mean that the world's hunger for power would be satisfied. Many European countries experience energy shortages which they are endeavouring to overcome by drawing on what might be described as 'unconventional' power resources.

Here, without a doubt, atomic energy takes the lead. The United Kingdom has on hand a ten-year plan for the utilization of atomic energy for producing electricity. Under this programme, twelve nuclear power reactors with a total capacity of $1\frac{1}{2}$ to 2 million kilowatts were to be completed by 1965. Technological progress in recent months, however, has already outdated this plan. During the Conference in Vienna, British scientists announced that, thanks to recent technical advances, 18 atomic power reactors can now be constructed within the same period, with a total capacity of 3 to 4 million kilowatts—about one-sixth of the entire electricity production in the United Kingdom in 1954. By further extensions of this programme, Britain expects by 1975 to produce as much as 25% of her total electricity from the atom.

As regards the United States, a country which owns other substantial energy resources such as coal, oil and water power, smaller reactors of various types are also being planned for use in less populated rural areas where needs are limited, as an important aspect of her programme for the development of atomic energy.

A report on Europe's needs of energy in the years to come and the resources from which they can be met has been prepared recently by a group of experts commissioned by the

Organization for European Economic Corporation.[†] This report emphasizes the fact that although the future energy prospects of the world have been fundamentally altered by the possibility of utilising nuclear power, this source is unlikely to provide more than about 8% of the total energy demand in Western Europe in 1975. It is a mistake to assume that atomic energy on a large scale is just round the corner, although there is no doubt that nuclear energy is sure to play a prominent part in later years.

A great deal of attention has therefore been paid to other types of economical power resources. It was reported in the Vienna Conference that scientists in Russia are endeavouring to exploit, on a large scale, energy from the sun. Valuable research has been carried out at the Krzhizhanowsky Power Institute in the Ararat Valley in Armenia. In 1955, an experimental solar electro-generator was constructed, using a parabolic mirror 6 feet in diameter, in which the sun's heat is converted into electricity by means of semi-conducting materials. The USSR is also planning a much larger generator which, when completed in two or three years' time, should yield a capacity of 1,200 kilowatts and will be the largest yet built. Already a solar machine has been constructed in the Soviet Union which each day turns 1,000 litres of salt-water into fresh-water.

In France, an attempt is being made to exploit the energy resources of the ocean. On the river Rance, in Brittany, French engineers are building the first tidal power plant to operate on an economical level. The motion of the tides will be utilized by this plant to produce 342,000 kilowatts of electricity annually, and, if successful, a far bigger project will be undertaken which would increase the country's electricity production by one-third.

Another French project being carried out at Abidjan, on the African Ivory Coast, makes use of the difference in temperature between water on the surface of the ocean and water from the depths—in this area a difference of 75° F. A turbine operating a generator is placed over the steam current established between a vacuum evaporator in which the surface water boils spontaneously, and a heat exchanger in which steam condenses when entering in contact with the cold water brought up from the depths of the sea. When completed, this power station will have a capacity of 3,500 kilowatts.

[†] "Europe's Growing Needs of Energy: How can They be Met?" Published by O.E.E.C., Paris, 1956.

OBITUARY

MEGHNAD SAHA (1893-1956)

THE life of late Prof. Saha has been an integral part of the growth of scientific research and organisation in our country, and the impact of his views and powerful personality will be felt for a long time to come in practically every aspect of the scientific activity. His dedication to science, his forthrightness and his utter disregard of personal comfort and interests in the pursuit of his chosen vocation will long remain an inspiration and an example.

Meghnad Saha was born on 6th October 1893, in a village in the district of Dacca (now in East Pakistan). He was the fifth child in a family of five sons and three daughters. The family was in a bad way financially, and Saha's early education was beset with many hardships. He passed the Entrance Examination in 1909 from Dacca standing first in East Bengal; and in 1911 he entered the Presidency College, Calcutta. Here he had amongst his contemporaries many who are now familiar names in Indian science, such as S. N. Bose, N. R. Sen, J. C. Ghosh and J. N. Mukherjee. P. C. Mahalanobis and N. R. Dhar were senior to Saha by a year or so. Here Saha learnt chemistry from P. C. Ray and physics from J. C. Bose. Saha took the M.Sc. Degree in applied mathematics (2nd in I Class) in 1915. He had at one time thought of competing for the Indian Finance Examination, but was not granted permission to appear because of his association with political revolutionaries like Jatindra Nath Mukherjee and Pulin Das in his college days. He now took up research in applied mathematics and physics. He was at one time doing as many as three private tuitions in different parts of Calcutta to support himself and his younger brother staying with him. However, these extreme difficulties did not continue for long as in 1916 Asutosh Mookerjee, the then Vice-Chancellor of the Calcutta University, started Post-Graduate Departments in Arts and Science directly under the University, and Saha was invited to join the Department of Mathematics as a Lecturer. His early lectures covered hydrostatics and the figure of the earth. (Dr. Ganesh Prasad was Professor of Mathematics at that time.) This was about the time when the World War I had shortly ended; and there was announced the momentous discovery of the deflection of light by the sun in accordance with the Einstein's theory of General

Relativity. Saha got deeply interested in relativity theory, and this and his study of quantum theory (and his fortunate contact with Agnes Clarke's book on astrophysics) soon led him to spectroscopy and astrophysics. He devoted the next four or five years to an intensive study of stellar spectra and allied problems. He formulated his theory of thermal ionization in his epoch-making paper entitled 'On Ionization in the Solar Atmosphere' which appeared in the *Philosophical Magazine* of 1920. It is pertinent to remark, as often statements have appeared to the contrary, that this paper was written while Saha was in Calcutta and was communicated to the *Philosophical Magazine* from Calcutta.

Saha was awarded the Premchand Roychand Scholarship of the Calcutta University in 1919 and he left for Europe in September 1919. He first went to U.K. and here he spent most of his time in the laboratory of the great spectroscopist Professor A. Fowler. He stayed for about five months in London and then went to Germany to work in Nernst's Laboratory where he stayed for about one year. Saha, during his stay abroad, came in contact with E. A. Milne, R. H. Fowler and C. G. Darwin who later made great contributions to Saha's ionization theory and its applications.

On return from England, Saha joined the University of Calcutta as Khaira Professor of Physics. In 1923 Saha was offered Professorship at the University of Allahabad which he accepted. The conditions of teaching and research in Allahabad were at that time quite different from what they were at Calcutta. In Calcutta largely due to the initiative and inspiring guidance of Asutosh Mookerjee systematic Post-Graduate teaching and research had already begun to make reasonable progress in the University. At Allahabad there was very little of advanced physics teaching: research was more or less unknown. Saha's great contribution at Allahabad was to lay the foundation of advanced teaching, and initiate and organise research in several fields such as thermal ionization, spectroscopy and wireless. It was in 1927 that Saha was elected to the Royal Society. As a recognition of this, the U.P. Government sanctioned a grant of Rs. 5,000 per annum for his research work. The Physics Department of the Allahabad University in the course of a decade became one of the most active research centres in the

country. Amongst his earliest associates in research, mention may be made of N. K. Sur, P. K. Kichlu and K. Majumdar. It was in association with Majumdar that Saha set up a high-temperature furnace and provided an experimental verification, though a somewhat crude one, of the formula of thermal ionization. Numerous papers appeared from the Allahabad School in atomic spectra, heats of dissociation, ionospheric studies, theories of radioactive decay and other subjects. It was while at Allahabad that Saha (jointly with B. N. Srivastava) published his world famous treatise on Heat which has now run into several editions. In 1925, Saha presided at the Physics Section of the Indian Science Congress. His address was on thermal ionization.

The scientific academies in India owe a large debt to Saha, for he played a vital role in creating an awareness in the country for the need of such academies and his role in founding them was of the utmost importance. The U.P. Academy of Science was founded in Allahabad in 1931. This was due almost entirely to Saha's efforts. Saha was unanimously elected the first President of the Academy. The Academy was renamed in 1934 as the National Academy of Sciences, India.

It is interesting to recall that one of the earliest symposia on national scientific problems was organised by the National Academy of Sciences in 1938. The subject was 'Power Supply'. Nehru presided on the occasion. Saha in opening the discussion observed: "The total output of work per capita per year in India is only 90 units, of which the major part is from manual labour, and only 7 units are from electrical power derived from coal, or running water, while in the advanced countries of the west, the total output is nearly 1,800 units, of which not more than 60 units are from manual labour, and the rest is all derived from forces of Nature." Later, in proposing a vote of thanks to the Chair, he said: "It was in the fitness of things that Pandit Jawaharlal has agreed to preside over this annual gathering of scientists in India. His position in the country can be described by a phrase which Americans use with respect to Abraham Lincoln: First in War, first in Peace, and next to Mahatma Gandhi, he occupies the first place in the hearts of his three hundred and fifty million countrymen. The time has now come for him to give a lead in peace-time work of reconstruction and consolidation of the country."

Saha was General President of the Science Congress at the 21st Session held in Bombay in 1934. In his Presidential Address he advo-

cated the formation of an Indian Academy of Sciences, and also for the establishment of a River Physics Laboratory for the study of flood and river utilisation problems. Saha's proposal led to the establishment of the National Institute of Sciences in India in 1935. Saha was elected President of the National Institute for the years 1937-39. In 1944, the Headquarters of the Institute were transferred from Calcutta to Delhi. At about the same time the Institute was recognised by the Government as the premier scientific society in the country and the Government provided funds to the Institute to enable it to function as such.

Saha visited Europe and America in 1936 as a Carnegie Trust Fellow. He visited the main centres of astrophysical research in Europe and the States. He attended the Tercentenary Celebrations of the Harvard University.

In 1938 Saha left Allahabad and joined the Calcutta University as Palit Professor in succession to C. V. Raman. Saha early realised the growing importance of nuclear physics, both as a subject of fundamental study and in its applications to natural progress. It is entirely due to him that the Institute of Nuclear Physics at Calcutta was founded in April 1948. The Institute is engaged in many problems such as beta-ray spectroscopy, nuclear resonance, and use of radioactive isotopes for medical purposes. It has also a cyclotron of pole diameter about 30 inches.

On his return to Calcutta, Saha began to take a keen interest in the activities of the Indian Association for the Cultivation of Science. He became the Secretary of the Association in 1944, and in 1946 he was elected President of the Association. The large-scale expansion that has taken place in the activities of the Association during the last decade is almost entirely due to Saha's initiative, enterprise and devoted work. The Association has now a new building in Jadavpur where it moved from Bowbazar in 1951.

Saha was succeeded by J. C. Ghosh to the Presidentship of the Association in 1950. Saha on his retirement from Palit Professorship of the Calcutta University, accepted the Directorship of the Indian Association for the Cultivation of Science.

The scientific work of Saha may be broadly divided under three heads: (i) astrophysics—this covers roughly the period 1918-25; (ii) spectroscopic and ionospheric studies—this covers roughly the period 1925-38; and (iii) nuclear physics—this covers the period 1938-55. The most creative years of Saha's scientific life belong to the first period. During these years he

devoted himself almost completely to astrophysics. In later years his interest became more widespread and a very large measure of his time and energy were taken up by teaching work and also other activities dealing with the impact of science on national life. The influence of Saha's teaching on the growth of physical research in the country can hardly be overestimated. Saha's greatest scientific work is his theory of thermal ionization and its applications to the spectra of stars. The great astronomer Otto Struve has observed: "His brilliant work on the ionization of stellar atmospheres, more than thirty years ago, resulted in a revolution in scientific thought comparable to that which occurred when Fraunhofer and Kirchhoff laid the foundations of the spectroscopic investigations of the celestial bodies. Saha's work has been a source of constant inspiration to virtually every astrophysicist during the present generation. My own early studies in stellar spectroscopy received an impetus from his work, and I believe that I have never written a scientific article in which I have not in one form or another made use of his theory of ionization."

Saha's work was the first effective step in linking the atom and the star together: The key to the understanding of stars lies in the understanding of atoms. If the fruitfulness of a theory is to be judged by its consequences, then Saha's work on thermal ionization must rank amongst the very greatest achievements

in the realm of modern physics. Much of the work in astrophysics during the last three decades has been dominated by Saha's theory and ideas. Apart from astrophysics, the theory has found numerous applications in ionospheric studies, flame conductivity and explosion reactions.

Saha was throughout his life an ardent nationalist. He took the keenest interest in problems of national planning, particularly in relation to science and technology. His numerous articles in *Science and Culture* bear witness to his wide interest, deep study and keen insight into these problems. His criticism was often provocative and trenchant, but it was motivated by deep patriotism and sincere, though often tenaciously held, convictions. During the years 1939-41, Saha did considerable work for the National Planning Committee which was organised by the Indian Science Congress under the Chairmanship of Jawaharlal Nehru.

Saha was married in June 1918 to Shrimati Radha Rani Saha—a lady who has been remarkable for her kindness, and her genuine simplicity and character. She has won the affection and respect of generations of students and colleagues of Saha. Saha is survived by his wife, three sons and three daughters. The eldest son, A. K. Saha, is Professor of Physics, Institute of Nuclear Physics, Calcutta.

D. S. KOTHARI.

WORLD'S FIRST SOLAR ELECTRIC STATION

THE world's first solar electric station is soon to go into construction on the Ararat Plain in Armenia. This site has been chosen because it surpasses all other parts of the U.S.S.R. in duration and intensity of sunshine.

The solar station will be in the form of a circle of about three-quarters of a mile diameter bordered with trees to keep the mirrors free of dust. At the centre there will be a 130-foot tower. The tower will be rotated by means of a steam boiler whose water will be heated to boiling point by the sun, raising the steam pressure to 30 atmospheres. The steam produced at the rate of 11 tons per hour will then be piped to the turbine of a 1,200-kilowatt electric station.

Twenty-three circular railway tracks are to be built around the tower on which automatic trains will carry 1,293 large mirrors of total

area 215,000 square feet controlled automatically to face the sun and reflect the sun's rays on to the flat walls of the boiler. When the sun rises, its rays will fall on photocells which will switch on the automatic devices to set the trains and the other installations going.

The station will not only be used experimentally, but for industrial purposes as well. Its power will go to drain the subsoil waters from the lowlands and direct them to the fields. It is expected that tens of thousands of acres of land will be brought into cultivation by this means. It is planned to use the exhaust steam for heating hothouses and flats, and for hot-water supplies to baths and laundries.

The station was designed in the main by the USSR Academy of Sciences' Power Engineering Institute.

XX INTERNATIONAL GEOLOGICAL CONGRESS, MEXICO D.F.

THE Twentieth Session of the International Geological Congress was held at Mexico D.F. from 4th to 11th September 1956, under the Presidentship of Dr. A. Garcia Rojas. El Senor don Adolfo Ruiz Cortines, President of the Republic of Mexico, opened the session in the National Auditorium of Mexico. Geologists from over eighty countries numbering nearly four thousand participated in the proceedings. The General Assembly divided itself into sixteen sections, each of them dealing with a specific aspect, namely, Cenozoic volcanology, correlation of the Mesozoics of the world, petroleum geology, hydrogeology, relation of tectonics to sedimentation, modern ideas on the origin of metallic and non-metallic minerals, palaeontology and evolution, plutonic rocks—their origin and relation to tectonics, geophysical applications, micropalaeontology, geochemistry, exploration geochemistry, isotope geology, geology as applied to engineering and mineral development, marine and submarine geology, petrology and mineralogy and diverse problems in general geology.

Besides these, full-fledged symposia were held on petroleum and natural gas, origin of manganese, the Cretaceous correlation, geochemical exploration, palaeogeography of the Cambrian system on Gondwanas. Several commissions met during the session, the most important of which was perhaps, the one on the geological map of the world. All the scientific meetings were held in the newly-built fabulous university city of Mexico, where massive buildings on a beautifully laid out campus with gigantic inlaid Mexican murals decorating the outer walls presented an imposing spectacle. Besides the large contingent from the United States, some of the countries like Russia, France, Canada, Great Britain and colonies were strongly represented by eminent geologists.

A number of papers of fundamental importance in the sessional meetings and symposia afforded a forum for discussion; perhaps equally important were the informal discussions between the delegates outside the actual session. A variety of sound films depicting the scientific studies and progress on the geological and allied fields provided an instructive attraction. The difficulty felt by most of the delegates was the too heavy programme making it obligatory for them to limit their interests to a few sections only. The Mexican Government lavished money and made perfect arrangements for the convenience and comfort of the delegates and everyone shared the feeling that the organisation of the session was a big job done in a

big way. The delegates were treated to Mexican folk dances on the night of 5th September in one of the most modern and beautiful theatres—The National Auditorium of Mexico. Some of the dances of the Mexican Indians showed strong affinity to folk dances in India. The display of horsemanship by gentlemen and ladies, girls and boys in the Mexican arena of The National Horse Club on Sunday, the 8th September, was very much appreciated.

Mexico is one of the leading countries in the production of such minerals as silver, lead, zinc and copper as well as petroleum. The geology of this region, which is a classical ground for the study of volcanism and ore deposition, affords extensive attraction for field observations. A large number of excursions to the different mining districts were organised before and after the Congress, and excellent guides and guide books were provided to those participating in these. There was a universal feeling that these excursions were as valuable to visiting geologists as the session itself.

The Indian Delegation consisted of Dr. M. S. Krishnan, Joint Secretary, Ministry of Natural Resources and Scientific Research, Government of India, Prof. C. Mahadevan, Head of the Departments of Geology and Geophysics, Andhra University, Waltair, and Mr. V. P. Sondhi, Director, Geological Survey of India, Calcutta; besides, Dr. K. P. Rode from Rajputana University, and Mr. B. B. Engineer, from Tata Iron and Steel Company, and Dr. M. Poornachandra Rao, of Andhra University (now working at the Scripps' Institute of Oceanography in Point-Four Programme of U.S.A.) also attended the session. A number of papers on the manganese deposits of India were presented by Mr. V. P. Sondhi and other officers from the Geological Survey of India, by Mr. B. B. Engineer of Tata Iron and Steel Company, and Prof. C. Mahadevan. Other papers from India were on geochemical prospecting by the officers of the Geological Survey of India; Gondwana correlation, hydrogeology and marine geology, by Prof. Mahadevan and his collaborators in the Andhra University. Dr. K. P. Rode expounded his new theory of 'Geo-kinematic' evolution in one of the meetings.

Unfortunately, the cable from the Government of India inviting the next session of the Geological Congress to India was received too late, only after the Council had accepted the provisional invitation of the Scandinavian countries headed by Norway. Among the delegates there was a general regret that India was not to be the next venue.

THE GENUS *SPIROCLYPEUS* FROM KUTCH, WESTERN INDIA

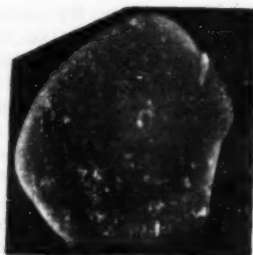
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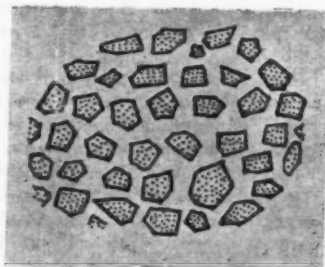
THE foraminiferal genus *Spiroclypeus*, largely employed in the correlation of the Lower Tertiary strata of Indo-Pacific region by Douvillé,¹ Vlerk,^{2,3} Nuttall,⁴ Vlerk and Umbgrove,⁵ Krijnen,⁶ Leupold and Vlerk,⁷ Tan Sin Hok⁸ and Rutten⁹ is being reported from Waior (N. 23° 25' E. 68° 44'), Kutch, Western India. This is the first report of the genus from this country.

clypeus pleurocentralis (Carter) from Arabia to the same genus. Subsequently, he referred *S. pleurocentralis* from the village Takah, South-Eastern Arabia, to the genera *Orbiculina* and *Heterostegina*. However, Douvillé described *S. pleurocentralis* from the Miocene beds of Borneo and brought the above under the synonymy of the same.

Many specimens of *Spiroclypeus ranjanae* sp.



1



2



3



4

FIGS. 1-4. *Spiroclypeus ranjanae* sp. nov.

1. External view, $\times 10$.
2. Pattern of reticulation on the external surface, $\times 42$.
3. Equatorial section, Form (A), showing bilocular nucleoconch, spiral lamina and chamberlets, etc., $\times 45$.
4. Axial section, $\times 45$.

Carter¹⁰ reported *Lycorhpris dispansa* (*Dis-cocyclina dispansa*) from Sind, Kutch and Arabia, and later erroneously referred *Spiro-*

nov., described here, were isolated from a compact yellowish white limestone outcropping at a distance of about 2 furlongs north-east of

the village Waior. The bed which is a part of the Arenaceous Group of Wynne¹¹ is about 15 feet thick and dips at a low angle of 3° to 5° towards south. It overlies a horizon, containing *Nummulites intermedius*, *N. clipeus*, *N. subclipeus* and *N. fichteli*, which is of Oligocene age (Nari Series) and is overlain, with a small break, by Lower Miocene beds (Gaj Series) from which *Miogypsina irregularis*, *Austrotrillina howchini*, *Lepidocyclus* (*Nephrolepidina*) *sumatrensis*, L. (N.) *borneensis*, *Miogypsinoidea dehaarti*, *Operculina* sp., *Spiroclypeus* sp., *Hypoprion* sp., *Ostrea angulata*, *Archaeolithothamnion*, *Lithothamnion*, and *Corallina* have been identified. This assemblage resembles somewhat the fauna of the lowest part of Bed No. 4 of Vinjan-Miani area.¹² *Spiroclypeus ranjanæ* sp. nov. is found associated with *Schizaster granti*, *Gypsina globulus*, *Rotalia*, *Eponides*, *Operculina* together with occasional *Nephrolepidina* and *Miogypsina* s.l. Neither *Eulepidina* nor reticulate *Nummulites* are present. The presence of *Miogypsina* s.l. along with *Spiroclypeus*^{13,14} indicates Aquitanian (basal part of Lower Miocene) age for this horizon.

DESCRIPTION OF *Spiroclypeus ranjanæ* SP. NOV.

The species has a flat test, occasionally undulating and roughly pentagonal in outline with a mamelon. The thickest portion of the test is a little away from the centre and the surface is covered with polygonal areas together with pillars at and round the mamelon. The diameter of the test varies from about 4 mm. to 7 mm. and maximum thickness from about 1.0 mm. to 1.4 mm. The ratio of thickness of the test varies from 1:3.5 to 1:4.5. The edge of the test is rounded and it belongs to the reticulate group—reticulation measuring 60 μ to 160 μ . All the specimens examined are megalospheric.

In equatorial section the initial chamber is 332 μ to 420 μ in diameter and is partly surrounded by a kidney-shaped second chamber measuring 364 μ to 392 μ . Length across both is 500 μ to 520 μ with a thick wall, varying from 8 μ to 40 μ round them. The coils rapidly increase in breadth. The whorls are divided into primary chambers by curved-septa which make an angle of about 20° with the spiral lamina. The curved-septa are 20 μ to 28 μ in thickness while the radial-septa are 8 μ to 16 μ thick. The primary chambers are divided into rectangular chamberlets whose maximum length and width are 200 μ and 120 μ respectively.

In axial section the equatorial layer is about 40 μ thick near the centre without walls which are also about 40 μ . This thins away a little towards the periphery. The lateral chambers are well marked and are 160 μ in length and 16 μ in height near the surface at the mamelon. The walls of the lateral chambers are 20 μ to 28 μ thick. There are pillars running between the tiers of the lateral chambers and measure 60 μ to 90 μ in diameter. There are 10 to 12 tiers of lateral chambers on both sides of the equatorial layers.

Remarks.—*Spiroclypeus ranjanæ* resembles somewhat in vertical sections *S. orbitoides* Douvillé but differs from the latter in its smaller size and thicker walls of the lateral chambers. *S. leupoldi* Vlerk, a pustulate form, cannot be identified with the present form due to its more globose shape, in larger lateral chambers in axial sections and other differences in internal measurements. *S. margaritatus* (Schlumberger) and *S. tidænganensis* Vlerk are species of the pustulate group and also differ from the present species in measurements.

I have named this species in memory of my daughter, Ranjana (who is no more), who had been the greatest source of inspiration to me in my work. I am grateful to Dr. M. F. Glaessner of the University of Adelaide, Australia, for confirming my identification and making valuable suggestions.

The work has been carried out in the scheme sponsored by the Scientific Research Committee, U.P., Allahabad.

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PHYSIOLOGY OF HIBERNATION OF THE APPLE-SNAIL *PILA VIRENS* (LAMARCK)

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THE bulk of research in the physiology of hibernation, as pointed out by Gorer,¹ has been on animals in cold countries and mostly on mammals. Regarding the factors that govern and co-ordinate the several metabolic changes involved in hibernation little is known at present.

The South Indian apple-snail, which has an amphibious mode of respiration, is well known for its remarkable powers of aestivation which may extend for two years or even longer. For experimental investigation, specimens of *Pila* were kept completely embedded air-tight in 'plastimould' for over six months, after which period they could be revived. The investigations on *Pila* show that its aestivation involves anaerobic metabolism and that the factors governing aestivation can be traced to biochemical changes in the cerebral ganglia of the animal.

In the study of anaerobic metabolism, the lactic acid content was determined by the method of Barker and Summerson² and glycogen by the method recommended by Good, Krammer and Somogyi.³ For the study of post-aestivation metabolism the animals were revived in water and the oxygen consumption determined by the standard Winkler's method.⁴

The free and protein-bound amino acids in the brain were studied by the circular paper chromatographic method of Giri *et al.*⁵ and the non-saponifiable fraction of the ether extract of the brain was tested for sterols by the Salkowski colour test.⁶ The magnesium and calcium of the blood were determined by the modified method of Denis and the Clark Colip modification of the Krammer Tasdall method given by Hawk *et al.*⁷

In animals which had been aestivating for six months the following biochemical features were observed in comparison with normal animals:—(1) accumulation of lactic acid (as lactate) in the tissues to about 40-50 mg. per animal; (2) fall in glycogen content by 80-85 mg.; (3) rise of magnesium content of the blood from the normal level of 3.5 mg. to 6 mg./100 ml. of blood and increased calcium level from 19.5 to 30 mg./100 ml. blood; (4) increase of glutamic acid concentration as a free amino acid in the cerebral ganglia to twice the nor-

mal concentration, as determined colorimetrically, and also an increase of asparagine (Fig. 1); (5) an increase to about ten times

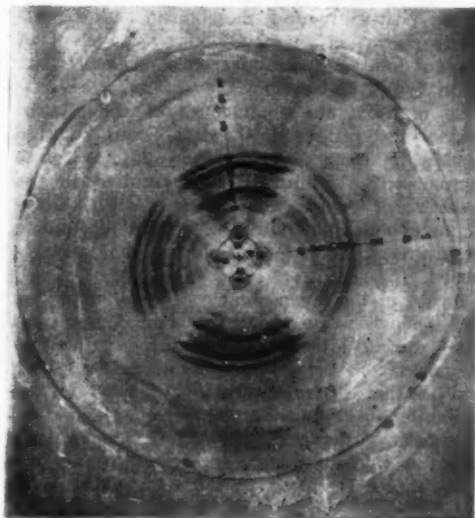


FIG. 1. Chromatogram showing the greater concentration of the free amino acids, glutamic acid (5) and asparagine (8) in the hibernating animal (H) compared with those of the active animal (F). The amino acids were identified by spotting the known and unknown in mixed chromatograms.

of the relative concentration of the non-saponifiable fraction in the ether extract of the cerebral ganglia: when tested for sterols this non-saponifiable fraction gave the reverse Salkowsky reaction,⁶ indicating the presence of non-cholesterol type of sterols; and (6) the pH of the blood is unaltered, being about 7.3 as in the normal animals.

Specimens of *Pila* which were experimentally kept in water under anoxic conditions (in water boiled and cooled out of contact with water, and with a layer of liquid paraffin on the surface), the following features were observed:—(1) an alteration of the pH of the blood to 4.5; (2) an increase in lactic acid accumulation to about thirty times as compared with that of aestivating animals; and (3) the absence of any change in the calcium and magnesium

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content of the blood as compared with that of normal animal.

These anoxic animals do not survive anaerobic life for more than two or three days. According to Slater,⁸ the period of anaerobic life in animals should be limited, and this is what we see in the anoxic animals. But in aestivation, the anaerobic glycolysis is regulated and can last for a shorter or longer period in response to environmental factors.

The post-aestivation metabolism, as experiments show,⁹ is characterised by 'payment of oxygen debt' and disappearance of lactic acid, as in typical anaerobiosis.

To find out the significance of the rise of magnesium in the blood, an aqueous solution of $MgCl_2$ (3 mg./100 ml.) was injected into normal active animals. This resulted in the lowering of oxygen consumption and lowering of metabolism as indicated by the incomplete 'payment of oxygen debt' during the recovery period.

A rise in the magnesium content of the blood has been observed in the hedgehog¹⁰ and bat¹¹ during hibernation but there is no rise in calcium in these animals. In the hedgehog and bat there is no anaerobic glycolysis but the aestivation of *Pila* definitely involves anaerobic glycolysis. Calcium neutralises the lactic acid, and the calcium lactate, according to my investigation,⁹ is stored in the foot. The pH of the blood of the aestivating *Pila* is unaltered due to this buffering action. *Pila* can aestivate with its anaerobic glycolysis as long as its lactic acid is neutralised by calcium.

Injection of the sterol fraction of the ether extract of the cerebral ganglia of hibernating

animals into an active animal produces the following changes:—(1) increase of magnesium content of blood; (2) increase of calcium content of blood; and (3) lowering of oxygen consumption. Injection of glutamic acid and asparagine into the active animal does not produce any change. There is therefore convincing evidence that the ten-fold increase in the sterol concentration in the brain is a governing factor for the rise of magnesium and calcium, which in their turn are regulating factors for other features in aestivation metabolism. The main controlling factor in the aestivation of *Pila* is evidently a sterol type of hormone produced in the cerebral ganglia. It must be added that suitable controls were set up in all the experiments. Further work is in progress.

My thanks are due to Prof. R. V. Seshaiya for suggesting this line of work and for guidance and instruction, and to the Government of India for the award of a scholarship.

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CHROMOSOME NUMBER OF MAN

IT has generally been believed that the somatic cell of man contains 48 chromosomes; but Drs. J. H. Tjio and L. Levan have suggested that the number should be 46, and in support Dr. Tjio showed preparations of human chromosomes at the Congress of Human Genetics held during August 1-6 at Copenhagen. Tissue cultures of fibroblasts from human embryonic lung were treated with colchicine to effect an accumulation of mitoses. Before fixation they were treated for one or two minutes with hypotonic saline solution, a method which had been used before by T. C. Hsu to induce scattering of the chromosomes. Fixation followed in 60% acetic acid twice exchanged to wash out the salts left from the culture medium and the

hypotonic saline that would otherwise have caused precipitation with orcein. Ordinary squash preparations were then made in 1% acetic orcein. Single cells were squashed under microscopical observation by slight pressure with a needle, and it was seen that no chromosomes escaped. On 22 cultures, 261 chromosome counts were made, and the chromosome number was found to be 46 ($2n=46$).

During the Congress, Drs. C. E. Ford and J. L. Hamerton, of Harwell, England, also showed photomicrographs of cells from three human testes confirming that the true number was 46 and estimating that the total length of the human chromosomes was 27 morgan units, half as long again as those of the mouse.

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UNIT CELL AND SPACE GROUP
OF CHERALITE

CHERALITE found in Travancore-Cochin State is a mineral of the monazite group. Wadia¹ reports variants containing 4-6% U_3O_8 and 19-33% ThO_2 . It has been described by Bowie and Horne.² These authors carried out X-ray powder study of the mineral and obtained the cell parameters.

Using a small fragment from a sample (supplied by the Raw Materials Division) which did not show any clear-cut faces, single crystal rotation and Weissenberg photographs have been taken. These show sharp and well-defined layer lines from which the following parameters (Table I) have been obtained.

From the indices of the systematic absences observed on these photographs, the space group was found to be $P2_1/n$.

TABLE I

	Values obtained here	Values by Bowie and Horne
<i>a</i>	6.70	6.74
<i>b</i>	6.87	7.00
<i>c</i>	6.39	6.43
β	103° 24'	104° 0'

Chemistry Division, P. G. KHUBCHANDANI,
Atomic Energy Establishment,
Bombay, July 16, 1956.

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CORONA THEOREM FOR AIR UNDER LOW FREQUENCY DISCHARGE USING A MAZE COUNTER

A DIRECT comparison of the breakdown potentials for corona discharges between coaxial cylinders in a gas is not possible for tubes of different electrode diameters. A comparison can, however, be made between the threshold potentials, V_1 and V_2 , for two wire-in-cylinder type discharge tubes of the same wire radius, r , but with cylinders of different radii, R_1 and R_2 , by applying the corona theorem¹

$$\frac{V_1}{V_2} = \frac{\log(R_1/r)}{\log(R_2/r)}$$

For discharges using metal electrodes, this method has been used by a number of workers¹⁻³ and the theorem has been established under conditions where the coefficients of ionization are negligible at points remote from the central electrode and space charges do not influence the breakdown. The present note describes the results obtained for the low frequency (50 c/s.) discharge in air using a Maze counter.

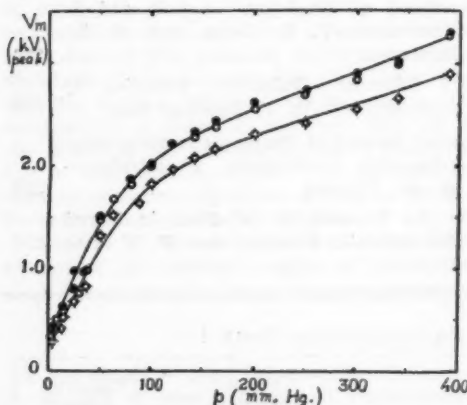


FIG. 1. Corona theorem for air using Maze counters. Lower curve breakdown potential for tube 1. Upper curve breakdown potential for tube 2. Experimental values are indicated by circles and calculated values by dots.

The general experimental arrangement was the same as that employed earlier.⁴ Atmospheric air dried over P_2O_5 was used. The discharge tubes were essentially Maze counters with the central copper wire of diameter, $2r = 0.05$ cm. and outer glass cylinders of outer diameters, $2R$ in the range from 0.69 cm. to 2.63 cm. The breakdown potential, V_m , was indicated by (i) a sudden rise in the current flowing through the tube, (ii) the initiation of

a glow, and (iii) the appearance of h.f. pulses on the current oscillogram. Typical values of the breakdown potential for only two tubes of $2R = 1.41$ cm. and 0.94 cm. are shown in Fig. 1. Values of V_2 (V_m for tube 2) calculated from values of V_1 (V_m for tube 1) using the corona theorem are also shown in Fig. 1. The close agreement between the calculated and the experimentally observed values clearly indicates that the corona theorem holds good for this type of discharge also. The results obtained for all glass ozonizers of the Siemens type are essentially similar.⁵ Details will be published elsewhere.

Dept. of Physics,
Saugar University,
August 2, 1956.

D. P. JATAR.
H. D. SHARMA.

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CHEMICAL INVESTIGATION OF COCCULUS HIRSUTUS (LINN.) DIELS.

Cocculus hirsutus belongs to the natural order Menispermaceae and is used in the Indian system of medicine for chronic rheumatism, fevers and digestive disorders.¹ The chemical investigation of the plant was therefore undertaken with a view to determine the active constituents.

The petroleum ether extract of the whole plant after chromatographic separation over alumina, gave the following substances: (i) A neutral white substance of m.p. 84–85° (Found: C, 81.7%; H, 14.1%; 'H', 0.23%; $-OCH_3$, nil). Its acetyl derivative had m.p. 47–48° (Found: C, 79.6%; H, 13.2%). (ii) A colourless solid of m.p. 143–144°, which gave a positive Liebermann-Burchard test for sterols and was identified as β -sitosterol by a mixed m.p. determination (Found: C, 83.6%; H, 11.9%; 'H' 0.33%; $C_{29}H_{50}O$ requires: C, 84.0%; H, 12.2%; 'H', 0.24%). Its acetyl derivative had m.p. 131–132° (Found: C, 81.3%; H, 11.8%; $C_{31}H_{52}O_2$ requires: C, 81.6%; H, 11.4%). (iii) A colourless neutral substance of m.p. 104°. (Found: C, 77.5%; H, 13.6%). In addition to the above solids, an appreciable quantity of a viscous oil was also obtained.

From the methanol extract of the whole plant, two substances were isolated: (i) a

nitrogen-free crystalline solid of m.p. 224-225°. It was soluble in hot water but insoluble in most organic solvents. It did not reduce Fehling's solution but gave a silver mirror test with ammoniacal silver nitrate, (ii) a small amount of a pale yellow substance having m.p. 119-120°.

The petroleum ether extract of the roots gave a large quantity of a brownish oil and a sterol of m.p. 156-57° (Found: C, 80.0%; H, 11.9%). The methanol extract of the roots gave positive tests for alkaloids and also reduced Fehling's solution. A 1% hydrochloric acid extract of the plant gave an alkaloidal base from which two picrates of m.p. 204-205° and m.p. 211° were obtained.

A fuller account will be published elsewhere.

Dept. of Organic Chemistry, R. M. NAIK.
Institute of Science, J. R. MERCHANT.
Bombay-1, July 15, 1956.

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CHARACTERIZATION OF THE PIGMENT IN RED TAMARIND (*TAMARINDUS INDICA*, LINN.)

DURING our investigations on the chemistry of tamarinds^{1,2} (*Tamarindus indica*, Linn.), we have come across a little-known variety of the tree which yields berries with flesh of a rose-red colour instead of the usual light-green colour. The berries from such trees are reputed to be 'sweet' compared to the very sour ones from the commoner variety. This, from our preliminary investigations, seems to be due to a very large part of the tartaric acid of the fruit (10-12%) being present in combined form as potassium bitartrate in the red variety as compared to the commoner variety where a large part of the acid is in free form.

The water-soluble rose-red pigment is an anthocyanin, probably identical with chrysanthemin, as can be seen from the following evidence.

The pigment was isolated from the juice by extraction with *n*-butanol and precipitation with ether, etc., according to the procedure used by Kertesz.³

The unknown anthocyanin was chromatographed together with cyanin (for reference) from red roses using butanol/acetic acid/water as solvent. The R_f values were 0.32 and 0.17 respectively. Only one spot was given by the unknown. From the table given by Bate-Smith⁴

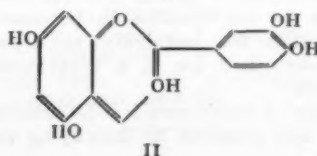
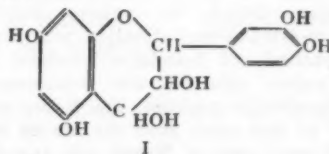
the former value suggests chrysanthemin or pelargonin.

The aglucones of the pigment and of cyanin were prepared by hydrolysis with 5N hydrochloric acid. These were chromatographed on paper, using the 'Forestal solvent'⁵ (water/acetic acid/con. hydrochloric acid).

The R_f value for both was the same, viz., 0.50. Absorption maxima of the anthocyanidins in ethanolic HCl solution were also identical (545 m μ). This agrees with values given by Bate-Smith for cyanidin.

The sugar moiety in the pigment was identified by neutralising the clear supernatant liquid after acid hydrolysis, concentrating and chromatographing with a reference mixture, using butanol/acetic acid/water as solvent. Only one strong spot corresponding to glucose was obtained. The osazone prepared from the concentrate had the crystalline form of glucosazone. Further, addition of sodium carbonate to the solution of the unknown pigment produced a blue colour, identical with that given by a crimson carnation extract (known to contain chrysanthemin). Chromatographically also, there was a marked similarity in the behaviour of the two pigments.

The tissue of green tamarind berry when boiled with dilute hydrochloric acid, gave a red colour, indicating the presence of a colourless precursor, a leuco-anthocyanin.⁶ The red pigment released was chromatographically identified as cyanidin. The leuco-base is soluble in water, but cannot be extracted from aqueous solution by ethyl acetate, which indicate its glycosidic nature.⁶ It is precipitated by hide powder, is astringent in taste and gives a strong Vanillin reaction. Being a flavan-3,4 diol (I) in nature⁷ the colourless leuco-cyanidin of green tamarind is thus more closely related to the catechins and condensed tannins⁸ than the anthocyanin pigment of red tamarind which is a polyhydroxy-2-phenyl benzopyrylium compound (II).



Grateful thanks are due to the Curator, Lalbagh Gardens, Bangalore, for the samples of red tamarind and flowers.

Central Food Tech.

Res. Institute, Mysore,
June 20, 1956.

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D. S. JOHAR.

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SOME OBSERVATIONS ON TETRALONE CHEMISTRY

WHILE investigating possible routes to synthesise condensed heterocyclic ring systems, it was suggested by Dr. K. N. Menon that 4-keto-1, 2, 3, 4-tetrahydro-2-naphthoic acid¹ may be made the starting point. The methyl ester of the acid gave the amide on shaking with ammonia, and the hydrazide hydrazone by treatment with hydrazine hydrate. The oxime of the methyl ester gave the oxime hydrazide. The Hofmann degradation of the amide and the Curtius degradation of the hydrazide did not proceed normally, but the latter gave interesting results. The hydrazide was treated in the usual way with nitrous acid, then with ethanol followed by hydrolysis with mineral acid. The only product that could be isolated was α -naphthol. The degradation of the oxime hydrazide also gave the same result. This result is of interest in conjunction with reports of such aromatisation recorded in the paper on the synthesis of lysergic acid.²

Having failed to obtain the desired 2-amino-4-tetralone, attention was directed to the synthesis of 3-amino-4-tetralone. α -Tetralone oxime afforded the *p*-toluenesulphonic ester in alkaline medium. The Neber rearrangement³ of this ester gave the amino ketone in rather poor yield. Worse still the free base proved to be too unstable to be useful and thus parallels the instability of 4-amino-1-benzoyl-5-keto-1, 2, 2a, 3, 4, 5-hexahydrobenz (cd) indole.²

Tetralone - 3 - carboxamide.—3-Carbomethoxy tetralone was prepared by esterifying the acid

with methyl alcoholic sulphuric acid. The ester (6 g.) was shaken with liquor ammonia (30 ml.). After 2 hr. the amide separated and after shaking for another hour the mixture was diluted with water and the amide collected. It crystallised in pale yellow plates from water, m.p. 183° to 184°, yield 4 g. (Found: C, 70.0 and H, 6.0. Calculated for $C_{11}H_{11}O_2N$: C, 69.8, H, 5.8.)

Oxime hydrazide of the ester.—The oxime of the keto-ester was readily obtained in theoretical yield by heating for 5 hr. on a water-bath the ester (2.5 g.) and hydroxylamine hydrochloride (1.2 g.) in pyridine (15 ml.). The oxime (2 g.) was refluxed for 4 hr. in absolute ethanol (20 ml.) containing hydrazine hydrate (10 ml.). The product obtained on dilution crystallised from ethanol in fine needles, m.p. 203°. It was soluble in acids and alkalis. (Found: C, 60.0, H, 6.2. Calculated for $C_{11}H_{13}O_2N_3$: C, 60.3, H, 5.9.)

The oxime hydrazide (0.5 g.) was dissolved in 10% hydrochloric acid (20 ml.) and treated with a slight excess of sodium nitrite solution under ice cooling. The solid that separated was collected and pressed free of water (m.p. 75-77° dec.). This was refluxed with absolute ethanol (10 ml.) for 3 hr., cooled, diluted with water and ether extracted. The ether extract afforded a liquid product and this was refluxed with a mixture of 30% sulphuric acid (10 ml.) and glacial acetic acid (5 ml.) for 6 hr. The cooled reaction solution was partially neutralised and filtered from a dark material that separated. The filtered solution deposited fine crystals on standing, which melted at 94-96° on crystallisation from water. Identified as α -naphthol by properties and mixed melting point.

Neber reaction with α -tetralone oxime.—The oxime (6.4 g.) was dissolved in sodium hydroxide solution (4 g. in 60 ml. of water) and under ice-cooling treated with *p*-toluene sulphonyl chloride (10 g.) dissolved in acetone (30 ml.) over a period of an hour with stirring, the temperature being maintained at 14-17°. After addition, the mixture was left standing in the cold for 40 minutes, the resulting solid collected and washed free of alkali. m.p. 96-97° from light petrol. The esterification with toluenesulphonic acid chloride did not proceed by employing the conventional pyridine method.

Rearrangement of the ester to amino tetralone.—The crystallised *p*-toluene-sulphonic ester (10 g.) was suspended in absolute ethanol (30 ml.) and treated with potassium ethoxide (1.3 g. of

potassium dissolved in 15 ml. of absolute ethanol). The mixture was shaken for half-an-hour when the potassium sulphonate separated out and the solution became green. After filtering and washing the sulphonate with absolute ether, the combined ethanol-ether filtrate was poured into more ether and extracted with 0.5 N hydrochloric acid. The reddish solution thus obtained was reduced to a small bulk under vacuum. The concentrate was treated with excess of sodium hydroxide solution and shaken with benzoyl chloride. The benzoyl derivative soon separated out. It formed amethyst coloured needles on crystallisation from ethanol, m.p. 174-177° (Found: C, 76.7, H, 5.9. Calculated for $C_{17}H_{15}O_2N$: C, 76.9, H, 5.7).

The free amine was extremely unstable. Its ethereal solution gave the acetyl derivative, m.p. 155-158°, on being left with acetic anhydride at room temperature (30° C.).

Dept. of Organic Chemistry, P. S. RAMAN.
University of Madras,
Madras-25, September 10, 1956.

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LIPOCHROMES OF *GYROSTOMA* SP. (SEA ANEMONES)

THE varied colours of the sea anemones have attracted the attention of a number of workers. Fabre and Lederer¹ have isolated the pigment actinioerythrin from the sea anemone *Actinia equina*. Heilbron, Jackson and Jones² confirmed this and were able to prepare a hydrolysis product violerythrin from the same pigment. Working with more species of sea anemones the same authors have isolated sulcatoxanthin from *Anemonia sulcata* and a wax-like pigment akin to actinioerythrin from *Tealia felina*. Fox and Moe³ have isolated an astacene-like pigment from the Pacific coast anemone *Epiactis prolifera*. The pigments of the plumose anemone *Metridium senile* have also been studied by Fox and Pantin.⁴

The sea anemone *Gyrostoma* sp. found along the shores of Bombay is characterised by a red pigmentation. The isolation of the main pigment from this animal and some preliminary

observations made on it are communicated in this note.

The method followed for extraction of the pigments was essentially the same as described by Heilbron, Jackson and Jones.² Fifty anemones were cut and pressed between filter-papers to remove as much moisture as possible. They were then minced and the entire mass extracted in stages with acetone-ether (1:1 vol.) in a Waring blender till the extract was colourless. The extract was distilled under reduced pressure to remove the solvent, and the pigments taken up in light petroleum. The phosphatides and sterols were removed by freezing and adding excess of acetone. The solvent was again distilled off under reduced pressure, the pigments taken up in petroleum ether and then subjected to adsorption chromatography on a column of alumina (Brockmann standardised Merck quality). The column was developed with benzene. An intense violet black zone was formed at the top of the column, and a yellow pigment spectroscopically identified as carotene passed through. The violet black zone was eluted and adsorbed on a calcium carbonate column when other impurities such as traces of phosphatides and sterols were removed.

The violet black pigment was eluted and efforts were made to recrystallise it from absolute alcohol. Due to paucity of material, it was only possible to obtain the pigment in a wax-like form. The absorption maxima of this pigment in CS_2 was found to be at 574, 538 and 497 m μ and in petroleum ether (40-60°) to be at 534, 497 and 490 m μ , whereas in ethyl alcohol a broad band (577-518 m μ) was noticed.

From its absorption spectra studies the pigment seems to be identical with actinioerythrin isolated by Fabre and Lederer¹ and later by Heilbron, Jackson and Jones² from the sea anemone *Actinia equina*.

Dept. of Biochemistry, M. V. RAJAGOPAL.
Institute of Science, KAMALA SOHONIE.
Bombay, July 7, 1956.

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VITEXIN FROM *VITEX PEDUNCULARIS* WALL

THE isolation of vitexin from the root bark and leaves of *Vitex peduncularis* Wall, has recently been reported by Sharma,¹ who also suggested a pentahydroxy-flavanone structure. The same roots have been under chemical examination and we report in this communication the results obtained during this investigation. This is found to be identical with a similar substance isolated from *Vitex littoralis*.² Vitexin has the following properties. Its molecular formula works out to be $C_{21}H_{20}O_{10}$, m.p. 265-66° C. (Found: C, 58.4, 58.6; H, 4.6, 4.8; $C_{21}H_{20}O_{10}$ requires C, 58.3 and H, 4.6%) and has no methoxyl groups. It formed a heptaacetate, m.p. 257-59° C. (Found: C, 57.8, 58.0; H, 4.7, 4.8; $C_{35}H_{34}O_{17}$ requires C, 57.9 and H, 4.5%) indicating the presence of seven hydroxyl groups instead of five as indicated by Sharma,¹ or eight as indicated by Nakaoki.³ Normal methods of methylation using dimethyl sulphate and aqueous alkali or methyl iodide and anhydrous potassium carbonate in acetone solution yielded no crystalline derivatives. However, methylation using vitexin heptaacetate and dimethyl sulphate and alkali in acetone solution following the procedure of Rao and Seshadri,⁴ gave a crystalline trimethyl ether, m.p. 290-91° C. (Found: C, 61.0, 60.9; H, 5.7, 5.8; $-OCH_3$, 20.0; $C_{24}H_{26}O_{10}$ requires C, 60.8; H, 5.5 and $-OCH_3$, 19.6%), which in turn formed a tetraacetate, m.p. 217-18° C. (Found: C, 59.9, 60.1; H, 5.4, 5.6; $C_{32}H_{34}O_{14}$ requires C, 59.8 and H, 5.3%), clearly indicating that out of the seven hydroxyl groups, only three are phenolic and the rest alcoholic in nature. Oxidation of vitexin or vitexin trimethyl ether with alkaline hydrogen peroxide yielded *p*-hydroxy-benzoic acid or anisic acid respectively while absolute alcoholic potash hydrolysis of vitexin trimethyl ether yielded *p*-methoxy-acetophenone identified as its 2:4-dinitrophenyl-hydrazone. The formation of *p*-methoxy-acetophenone during the alcoholic potash fission clearly indicates that it belongs to the flavone group. The colour of the substance (canary yellow), the production of a red colour in alcoholic solution with magnesium and hydrochloric acid and the formation of a tetranitro-apigenin² on nitration of vitexin, clearly indicate that vitexin is an apigenin derivative. The difference in the molecular formula of vitexin and apigenin, leaves six carbon atoms to be accounted along with four alcoholic hydroxyl groups and one oxygen atom. This could be accounted for only by a

glucose unit which should be present in the phloroglucinol part of the benzopyrone nucleus and not in the side phenyl nucleus. The exact nature of the glucosyl link in vitexin is still under investigation.

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Andhra University, V. VENKATESWARLU.
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ADSORPTION OF CARBON MONOXIDE BY NICKEL: FORMATION OF NICKEL CARBONYL

MOND AND CO-WORKERS^{1,2} showed that CO and nickel powder react at 30° C. and above to form a carbonyl of the composition $Ni(CO)_4$. During our studies on the adsorption of CO by nickel powder in the range -191° C. to 53° C. we observed that the maximum adsorption occurred at 0° C. Since chemisorption seemed to predominate at 0° C. several experiments under different conditions were carried out to ascertain exactly the adsorption complexes formed at that temperature. This work involved accurate determinations of the adsorption and the subsequent desorption at the same temperature by evacuation by a Töpler pump with arrangements to decompose the desorbed products so as to collect and determine them accurately.

The apparatus employed is shown diagrammatically in Fig. 1. The nickel powder catalyst

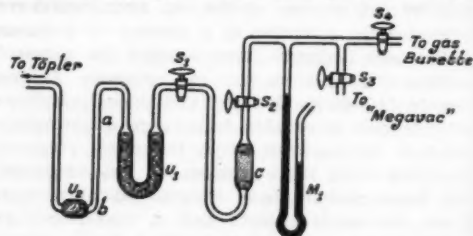


FIG. 1

as well as the carbon monoxide employed for this work were prepared with great care observing all the necessary precautions.

The tube C containing nickel powder (6.1 g. kept between glass wool plugs) communicated with the gas burette via stopcocks S_2 and S_4 on one side and with U tubes U_1 and U_2 and the Töpler pump via stopcock S_1 on the other. The U tubes contained purified and ignited

glass wool. The nickel powder in tube C was kept heated at 300° and exhaustively degassed by means of a Cenco megavac pump, keeping taps S_1 and S_4 closed while S_2 and S_3 were open, whereas the system to the left of S_1 was evacuated thoroughly by means of the Töpler pump. After evacuation and with taps S_1 , S_3 and S_4 closed, the catalyst tube C was kept surrounded by a bath of melting ice and maintained at 0° C. throughout the experiment. After cooling for about an hour, the adsorption was started by admitting known quantities of CO successively from the gas burette into the tube C by operating tap S_4 and allowing an adequate interval after which the pressure was noted from manometer M_1 . It was observed that the intake of CO by nickel was very rapid at first but slowed down after 48 hours. The desorption was then commenced, keeping U_1 cooled at -191° in a liquid air-bath while U_2 was kept heated at 190° by means of a liquid paraffin-bath, the tube C being in the ice-bath. Stopcock S_1 was slowly opened when the gas from the catalyst tube and the manometer of the adsorption apparatus flowed into the Töpler pump through U_1 and U_2 . The pump was operated very gently at first so that the desorption was relatively slow. The system was finally evacuated thoroughly and the gas obtained was collected and measured in the gas burette. Stopcock S_1 was then closed and the liquid air-bath removed while still maintaining U_2 at 190°. Colourless crystals were seen inside U_1 and these melted soon and evaporated liberating a large volume of gas which flowed into the Töpler and at the same time depositing a thick and bright mirror of nickel in the portion a-b in U_2 . The Töpler pump was operated until no more gas came off. The CO thus obtained was collected and measured. The portion of the tube containing the nickel deposit was cut off and the nickel dissolved and estimated by the dimethyl glyoxime method.

The experiment was repeated several times with intervening soaking at 300° of the nickel powder in hydrogen and thorough degassing. The typical results of two such experiments are presented in Table I.

Carbon dioxide could not be detected in the desorbed gas in any of the experiments.

The stoichiometric ratios given in column 7 of the table establish that the concerned compound is $Ni(CO)_4$.

It can be definitely concluded that during chemisorption of CO by nickel powder at 0° C., $Ni(CO)_4$ is the only product formed and that there is no evidence for the formation or presence of any other surface adsorption complex.

TABLE I

Experiment	CO added c.c.	Time of contact hr.	Unadsorbed CO collected c.c.	CO obtained from decomposition of the carbonyl		Ni deposit obtained		Ni : CO in the compound desorbed and decomposed
				c.c.	in 10 ⁻⁴ g. mol.	mg.	in 10 ⁻⁴ g. mol.	
1	116.3	48	15.1	96.9	43.3	63.0	10.7	1 : 4.046
2	115.2	60	6.1	106.3	47.5	70.1	11.9	1 : 3.993

Further work is in progress on the adsorptive characteristics of the nickel mirrors obtained from experiments of this type as well as similar detailed studies of adsorption of carbon monoxide by nickel at other temperatures.

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Bangalore, August 22, 1956.

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DETECTION OF GROWTH FACTORS IN CULTURE FILTRATES OF FUSARIA

THE occurrence of certain unknown growth factors in culture filtrate of *Fusaria* has been previously shown by stimulation of rooting in cut shoots of tomato¹ and cotton² treated to these filtrates and recently by the *Avena* cylinder technique.³ Another simple and rapid test for growth factors in *Fusarium* culture filtrates is described here which was found to give very consistent and satisfactory results in large-scale tests of filtrates.

A 4" × 4" square piece of gauze cloth was tied to the mouth of a 100 ml. beaker with the cloth sagging concave inside the beaker. The required quantity of *Fusarium* test culture filtrate (dialyzed) was added to 100 ml. distilled water in the beaker. Twenty-five paddy seeds (Co. 17 variety), pre-soaked for 4 hours in distilled-water, were spread on the gauze cloth and covered lightly by folding the loose ends of the cloth, the beakers incubated in a moist chamber at 27-29° C. for three days and the root length of the germinating paddy measured. Increase in root length achieved in the case of culture filtrates of many *Fusarium* species (Plate I, Figs. 2, 4), over the control (distilled-water), indicated the presence of growth factors in the filtrate whilst filtrates of certain other species inhibited root growth, as for

example (*F. moniliforme* and *F. udum*) (Plate I, Figs. 1, 5). Similar increase in root length was also observed in the case of wheat and mustard seeds treated to the culture filtrates but paddy gave best results.

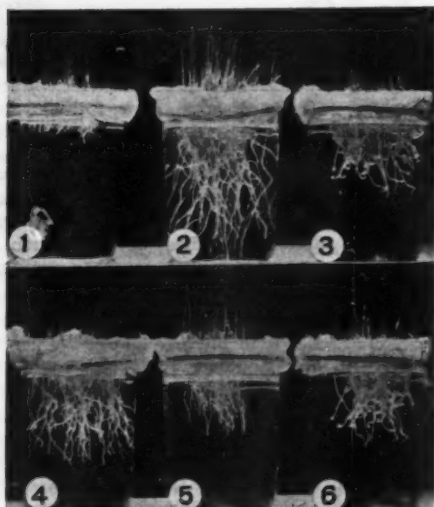


PLATE I. FIGS. 1-6.

Effect of culture filtrates of (1) *F. moniliforme*, (2) *F. varinfectum*, (4) *F. orthoceras* and (5) *F. udum* on root growth of paddy; (3) and (6) are controls.

Bioassay and chromatographic analysis indicated the presence of B vitamins, various amino acids, organic acids and sugars in the culture filtrates and these were similarly tested on paddy. None of the sugars, organic acids and the B vitamins increased root length but marked stimulation was achieved with tyrosine and phenylalanine at 25, 50 and 100 ppm. concentrations which was comparable to increase in root length produced by *Fusarium* culture filtrate at 5% level. Other amino acids exerted no stimulatory effect. These results indicate that stimulation of root elongation in paddy produced by culture filtrates of *Fusaria* are in part due to tyrosine and phenylalanine present in the filtrates. Details of this work will be published elsewhere.

I thank Prof. T. S. Sadasivan for his criticism and interest in this work and the National Institute of Sciences of India for the award of an I.C.I. Research Fellowship.

University Botany Lab., C. S. VENKATA RAM.
Madras-5, July 30, 1956.

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BACTERIAL RED STRIPE DISEASE OF SUGARCANE CAUSED BY *XANTHOMONAS RUBRILINEANS* IN BOMBAY STATE

SPECIMENS of sugarcane leaves (variety Co. 419) affected by bacterial red stripe disease, were received from the Godavari Sugar Mills, Kanhegaon, District Ahmednagar, in October 1955. The leaves were marked with long, narrow, dark red, longitudinal streaks which were $\frac{1}{2}$ -1 mm. wide and coalescing at places to form broad bands. A species of *Xanthomonas* was isolated from the lesions and proved pathogenic to sugarcane (variety Co. 419) on re-inoculation. Jowar (*Sorghum vulgare* Pers.) was also successfully inoculated. A study of the morphological and biochemical characters of the organism showed that it was indistinguishable from *Xanthomonas rubrilincans* (Lee et al.) Starr and Burkholder.

McRae (1933)¹ and Padwick (1940)² reported occurrence of bacterial red stripe of sugarcane in India but the organism has not been isolated nor has its pathogenicity to sugarcane been proved as yet. This is, therefore, the first time that this organism has been isolated and identified.

Further work is in progress.

Plant Pathological Lab.,
College of Agriculture,
Poona-5, July 7, 1953.

V. P. BHIDE.
R. K. HEGDE.
M. K. DESAI.

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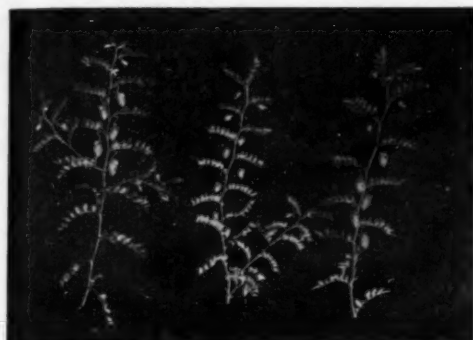
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TINY SEED AND TINY POD SEGREGATES IN BENGAL GRAM (*CICER ARIETINUM*)

A NUMBER of mutants and segregates in flower, pod and seed characters in Bengal gram (*Cicer arietinum* L.) have been reported by many workers.²⁻⁵ Ekbote¹ reported a tiny leaf mutant in Bengal gram but no difference in pod and grain size was observed in the mutant. So far, occurrence of tiny seed and tiny pod segregates or mutants have not been reported by any one. The present article therefore deals with the description as well as the inheritance of such segregates isolated at the Agricultural Research Station, Niphad, District Nasik.

In 1945-46, in the course of study of some hybrid material in Bengalgram, two plants altogether different from the normals were first spotted in the F_3 lines 140 and 440 of a cross

between Wh.F. Wh.Gr. III \times Chafa. In F_4 generation, two types of grain sizes were observed in culture 440 and the same have been isolated. The plants appear to have arisen through reduced leaf, pod and seed sizes and were found to breed true in further generations (Figs. 1 and 2). The segregates were studied



White flower Mutant Chafa
White grain-III

FIG. 1. Showing the leaf and pod variation of the mutant in comparison with the parents.

for their pod and seed size and the description of the same together with the parents of the cross is given in Table I.

TABLE I

Showing pod and seed characters of the three segregates in comparison with Chafa and Wh.F. Wh.Gr. III

Characters	Varieties				
	Chafa	Wh.F. Wh. Gr. III	Segregate 140-14	Segregate 440-6	Segregate 440-9
Mean length of pod in cm.	1.63	1.7	1.2	1.16	1.18
Mean breadth of pod in cm.	0.81	0.83	0.54	0.54	0.54
100 grain weight in g.	16.33	10.23	5.40	1.49	3.15

From Table I it will be seen that there is a definite reduction in pod and seed size of these segregates. As far as pod size is concerned, no marked difference is seen among these three segregates, while in seed size definite variation is observed (Fig. 2). There is definite variation in leaf size also and observations on this character will be published elsewhere.

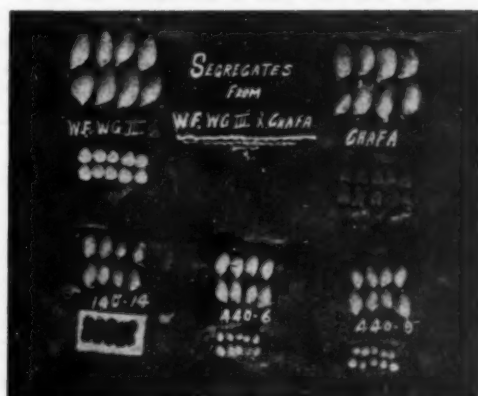


FIG. 2. Segregates from Wh.F. Wh.Gr. III \times Chafa.

From inheritance study, segregate 140-14 only was crossed with a normal variety "Chafa", an improved strain of the station in the year 1947-48. The F_1 was normal. As a very small population was available for study in F_2 , confirmatory studies were carried out on the progenies of all 23 plants in F_3 . Individual plants from each line of F_3 were studied for their pod and seed size characters. Details of F_2 and F_3 studies are given in Tables II and III.

TABLE II

F_2 segregation in the cross 140-14 \times Chafa

Phenotypes		Obs. (O)	Calc. (C)	(O-C)	(O-C) ² /C
Normal	..	16	17.25	-1.25	0.09
Tiny seed and tiny pod		7	5.75	1.25	0.27
TOTAL	..	23	23	..	0.36

$P=0.5$ to 0.7 ; $\chi^2=0.36$

TABLE III

Behaviour of segregates in F_3

Phenotypes of families	Obs. (O)	Cal. (C)	(O - C)	(O - C) ² /C	
Normal	..	5	5.75	-0.75	0.098
Tiny seed and tiny pod	7	5.75	1.25	0.27	
Segregations	..	11	11.50	-0.50	0.021
TOTAL	..	23	23	..	0.38

$P=0.8$ to 0.9 ; $\chi^2=3.89$.

The goodness of fit test of the F_2 and F_3 results proves that segregation of the character

tiny seed and tiny pod is monogenic giving 3 normal to 1 tiny seed and tiny pod plants. In the F_2 and F_3 study it is observed that the tiny pods always contain tiny seeds only. No normal pods show tiny seed in it. The segregates have also been crossed with other varieties available at the station and the details of these studies as well as the genetic symbols for these segregates will be published in due course.

My thanks are due to Sri. J. A. Patil, B. B. Kushare, and other staff members who have helped to collect the data. I am highly obliged to Dr. Solomon for going through the article and giving valuable suggestions.

Crop Res. Section, B. B. CHAUDHARI.
Dept. of Agriculture,
Bombay State, Poona-5,
June 28, 1956.

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SOME MYCOPHAGOUS INSECTS AND THEIR PARASITES ASSOCIATED WITH SUGARCANE

JOHNSON¹ AND ECKSTEIN² observed thrips and earwig (*Forficula auricularia* L.) on maize smut and other fungi. Ramakrishna Iyyar³ collected *Anaphothrips fungivora* feeding on wheat rust. Hayward⁴ found *Phalacrids*, *Brachytarsus zeæ* and *Anthicus albifasciatus* associated with sugarcane smut.

During a study of sugarcane crop and *Saccharum spontaneum* variants at the Sugarcane Breeding Institute, Coimbatore, the author collected the following four species of insects and one species of the *Acarina* from sugarcane smut and two species from *S. spontaneum* rust. While studying their biology and habits, three parasites were also reared from these insects; of these *Apanteles aræceri* has already been described by Wilkinson⁵ from unidentified cocoon. Barring *Phalacrus immarginatus* and *Kittada coimbatorensis* which were reported by the author earlier,^{6,7} all other insects appear to be first records of mycophagous insects and their parasites associated with sugarcane.

The following insects were collected from sugarcane smut (*Ustilago siltaminea*) during August to December 1955:—*Phalacrus immarginatus* Chap. (Coleoptera—Phalacridæ); *Diphyl-*

lus sp. nr. *egens* Grouvella (Coleoptera—Cryptophagidæ); *Troctes bostrychophilus* Badonnel—Indian race (Psocoptera—Psocidæ); *Ascalenia* sp. (Lepidoptera—Cosmopterigidae); *Blattiscius keegani* Fox (Acarina—Acoesejidae).

Insects from rust (*Puccinia kuehnii*) of *Saccharum spontaneum*; *Kittada coimbatorensis* Agarwal (Diptera—Itonididae); *Anaphothrips fungivora* Ramakrishna Iyyar (Thysanoptera—Thripidae).

Parasites of above insects—*Apanteles aræceri* Wilk. (Hymenoptera—Braconidae, reared from *P. immarginatus*); *Ceraphron* sp. (Hymenoptera—Ceraphronidae, from *K. coimbatorensis*); *Amitus* sp.? (aleurolobi) Mani. (Hymenoptera—Platygarteridae, from *K. coimbatorensis*).

These small insects have not so far been considered to be of any economic importance, presumably because their populations did not warrant inclusion among insects of economic importance. The immature stages of almost all the above insects were observed feeding on the spores. On opening alimentary canal, these spores could easily be seen under high magnification.

Although these insects may benefit the host plant by consuming some of the spores, their population is hardly sufficient to control the fungus. On the other hand, it may be one of the ways of carrying the fungus spores, which are adhering to their legs and other body parts to the healthy canes and thus spreading the fungus or at least serving as source for secondary infection. The insects being small are in all probability carried by strong winds, thus aiding in the dissemination of the spores to new plants. Being quite active, the insects themselves migrate to neighbouring plants, thus inadvertently helping the spread of the spores.

Grateful thanks are due to Shri N. L. Dutt for encouragement during the course of these studies and to the Commonwealth Institute of Entomology for kindly identifying the insects.

Sugarcane Breeding Inst., R. A. AGARWAL.
Coimbatore, July 16, 1956.

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A NEW MUTATION IN *CAJANUS*
CAJAN MILLSP.

HOOKE¹ described *Cajanus indicus*, Spreng (*C. cajan* Millsp.) as a monotypic species in India having, besides the other characters, lanceolate leaflets, keel petals united at the top and monocarpellary pistil. Later, Singh et al.² reported a new type under *C. obcordifolia*, Singh, differing from the original species *C. indicus* by obcordate leaflets and free keel petals (not united).

Poona, by Shri D'Cruz whose kind help is gratefully acknowledged by the author.

Crop Research Station, N. B. KAJJARI.
Dept. of Agriculture, Bombay,
Poona, June 13, 1956.

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TABLE I

Sl. No.	Name	Leaflets shape	Keel petals	Pistil	Apex of leaflets	Petal colour
1	<i>C. cajan</i> (Normal)	Lanceolate	United at the top	Simple or monocarpellary	Acute to slightly acuminate	Pale yellow, back of standard veined with red or yellow
2	Round leaf	Obovate	do	do	Obtuse	Pale yellow, back of standard with self-coloured veins
3	Tiny leaf	Lanceolate	do	do	Acute to slightly acuminate	Pale yellow, back of standard veined with red
4	<i>C. obcordifolia</i>	Obcordate	Free in the open flower	do	Mucronate & retuse	do
5	New Mutant	do	United at the top	Polycarpellary & Apocarpous	do	do

Pandya et al.³ reported two leaf mutants in *C. cajan*, one having obovate leaflets with rounded base and apex and the other having tiny leaflets with short petiole.

In 1953, at the Agricultural Research Station, Annigeri, District Dharwar, a new mutant was detected in the progeny row number 115-3 in the selections from local varieties. This mutant has obcordate leaflets and keel petals united at the top. Further, its pistil is polycarpellary (with two or three pods in each calyx) and apocarpous.

Table I gives the contrasting characters of the four types described above.

During 1954, 48 progenies were raised from selfed seeds of the new mutant and it was observed that all the plants were breeding true, to the above characters. Similarly, these results were confirmed in 1955 by raising 200 progenies.

The new mutant along with normal tur was subjected to cytological examination but no difference in the number and morphology of chromosomes were observed. The chromosome number in both the types was identical, being $2n = 22$.

The cytological examination was carried out in the Laboratory of the Economic Botanist to Government, B. S. College of Agriculture,

A SYNTHESIS OF 4-ACETOMETHYL-
COUMARIN DERIVATIVES

SETHNA AND SHAH¹ observed that oracetophenone and its monomethyl ether behave abnormally when subjected to Kostanecki-Robinson acylation in producing coumarins. They assigned provisionally a 4-acylmethylcoumarin structure to these compounds in preference to the alternative 3-acyl-4-methylcoumarin structure. The present investigation was undertaken to provide synthetic evidence bearing on the structure of these compounds.

As a model for the synthesis of 4-acetomethylcoumarins, a synthesis of 4-acetomethyl-7-methylcoumarin was first carried out. 7-Methylcoumarin-4-acetic acid² was converted to a crystalline acid chloride (I) which was then condensed with sodio-diethylmalonate. Acid hydrolysis of the condensation product finally yielded the required 4-acetomethyl-7-methylcoumarin (II), colourless silky needles, m.p. 199-200° (Found: C, 72.6; H, 5.9; $C_{18}H_{12}O_3$ requires C, 72.2; H, 5.6%) dinitrophenylhydrazones, deep orange needles, m.p. 219-220° (Found: N, 14.0; $C_{19}H_{10}O_6N_2$ requires N, 14.2%) semicarbazones, colourless small needles, m.p. 227-228° (Found: N, 15.6; $C_{14}H_{10}O_6N_3$ requires N, 15.4%).

The same coumarin (II) was also synthesised in better yields by an alternative route by treating (I) with excess of diazomethane and reducing the corresponding crystalline diazo ketone with hydriodic acid.³

The starting material required for the synthesis of 4-acetomethyl-5-methyl-7-methoxycoumarin is 5-methyl-7-methoxycoumarin-4-acetic acid (III), which could possibly be obtained from ethyl 5-methyl-7-hydroxycoumarin-4-acetate-8-carboxylic acid (IV) by decarboxylation, methylation and hydrolysis respectively. Attempts to synthesise the latter by condensing *p*-oresellinic acid with ethyl acetonedicarboxylate in presence of concentrated sulphuric acid, resulted in the formation of 4:5-dimethyl-7-hydroxycoumarin-8-carboxylic acid, m.p. 225° (d), obtained earlier by Sethna and Shah¹ by condensing *p*-oresellinic acid with ethyl acetoacetate. Coumarin (IV) could, however, be obtained by using phosphorous oxychloride as the condensing agent. It crystallised from alcohol in colourless needles, m.p. 230° (d) and gave a strong bluish green fluorescence with alkali and a reddish violet colouration with alcoholic ferric chloride. (Found: C, 59.0; H, 4.8; C₁₅H₁₄O₇ requires C, 58.8; H, 4.6%). When heated above the melting point, (IV) was decarboxylated to ethyl 5-methyl-7-hydroxycoumarin-4-acetate, colourless needles, m.p. 171-172°, giving a bluish green fluorescence with alkali (Found: C, 64.1; H, 5.3. C₁₄H₁₄O₅ requires C, 64.1; H, 5.3%). This was methylated with dimethyl sulphate to ethyl 5-methyl-7-methoxycoumarin-4-acetate, colourless needles, m.p. 126-127° (Found: C, 65.6; H, 5.9; C₁₅H₁₆O₅ requires C, 65.2; H, 5.8%), which was then hydrolysed with acid or alkali to (III), colourless needles, m.p. 177-178° (d). (Found: C, 63.3; H, 4.9; C₁₃H₁₂O₅ requires C, 62.9; H, 4.8%).

Reduction of the diazo ketone obtained from the acid chloride of (III) yielded finally 4-acetomethyl-5-methyl-7-methoxycoumarin, colourless needles, m.p. 156-157° (Found: C, 67.8; H, 5.5. C₁₄H₁₄O₄ requires C, 68.3; H, 5.7%), dinitrophenylhydrazones, small dark orange needles, m.p. 178-180° (Found: N, 11.7. C₂₀H₁₈O₇N₄ requires N, 13.1%). It differed from the Kostanecki-Robinson acetylation product of oracetophenone monomethyl ether, m.p. 123-124°, obtained by Sethna and Shah. Thus, the products obtained by Sethna and Shah have, in all probability, the alternative 3-acyl-4-methylcoumarin structure, the synthesis of which is in progress.

Microanalyses were carried out by Dr. G. D. Shah, Mr. V. S. Pansare and Mr. V. N. Mulay. Fuller details will be published elsewhere.

National Chemical Lab. of India, J. L. BOSE.
Poona, May 26, 1956. R. C. SHAH.

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A RECORD OF *GLOBIDIUM LEUCKARTI* (FLESCH) FROM A HORSE IN INDIA

Coccidiosis is an important protozoan infection in domestic animals, and is caused by members of the genera *Eimeria* and *Isospora*. Sampson¹ recorded a disease due to coccidia in a horse without describing the parasite. Selan and Vittoria² claimed to have detected a coccidian in the lungs and gall-bladder of a horse in Italy. But the infection has not so far been described satisfactorily to form a definite opinion about the species causing it. Flesch³ made an interesting record of *Globidium* from the small intestine of a horse and he gave the name *Globidium leuckarti* to it. Reichenow⁴ described large oocysts in the feces of donkeys and he considered these oocysts as the mature macrogametes of *G. leuckarti*.

The present author while examining a sample of feces collected from a horse at Mangrol (Bombay State) in October 1955, came across a large number of oocysts belonging to *Globidium leuckarti*. This is the first record of this species from India.

Globidium leuckarti—Flesch, 1883.—Oocysts large, 84 × 56 μ, deep brown in colour, oval in shape with one end pointed than the other. According to Reichenow⁴ oocysts measure 80-87 × 55-59 μ. Outer wall of the oocyst thick, granular, brownish in colour, 5-7 μ thick and slightly thinner towards the pointed end. Micropyle distinct without a polar cap. Inner wall of the oocyst thin and transparent. Sporont 35-40 μ, circular and coarsely granular in consistency. Sporocysts four in number, 30 × 12 μ without a oocystic residuum. Sporozoites two in each sporocyst, spindle-shaped, 20 × 5 μ with a small amount of sporocystic residuum. Sporulation time 15 days during hot days of October.

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G. leuckarti is a rare parasite of equines and the details of the developmental stages in the alimentary canal have not been studied so far. The pathogenicity of *G. leuckarti* is not definitely known except that it brings about hypertrophy of the cells of the gut. In severe cases diarrhoea mixed with blood may set in, the animal becoming emaciated. Reichenow succeeded in getting the oocysts to develop and found that they contain four sporocysts, each with two sporozoites. In other words, they are of the *Eimeria* type.

Reichenow⁵ lists *Globidium* as a subgenus of *Eimeria* and there is a great deal of justification for this view. Reichenow states that the oocysts do not rise to the surface in salt solution when centrifuged, and it is doubtful whether the oocysts of *Globidium* will ordinarily rise in any other solution. Hence, it would be very easy to miss them in routine examinations. This is true of some members of the subgenus *Jarrina* also, so, it is not a characteristic of *Globidium* alone.

Thanks are due to Prof. N. D. Levine of University of Illinois, for having kindly identified the specimen and for offering his remarks on the parasite.

Bombay Veterinary College, L. S. HIREGAUDAR.
Bombay-12, July 16, 1956.

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ON FORECASTING HEAVY RAINFALL IN MALABAR, SOUTH KANARA AND TRAVANCORE-COCHIN DURING JUNE AND JULY

APPLICATION of the barometric pressures of two or three stations in forecasting rainfall in certain areas has been attempted by some workers. Roy¹ has shown how the pressure distribution at Calcutta, Berhampur and Barisal in South Bengal (pre-partition) can be usefully utilised in forecasting rainfall in South Bengal during the Nor'wester season. Similarly, Roy and Bhattacharya² have shown how the difference of pressures at Khanpur and Rawalpindi in the Punjab (P) can be used for forecasting rainfall over North-East Baluchistan during July and August. But, so far, no similar tests appear to have been made to see whether and how far heavy rainfall can be forecast from the consideration of the baro-

metric pressures of two or three stations. An attempt in this direction has been made in this note.

In the case of Malabar-South Canara and Travancore-Cochin the south-west monsoon sets in normally in the beginning of June and heavy rainfall occurs on a larger number of occasions during June and July than in other months. Station level barometric pressures at Mangalore, Calicut (Kozhikode) and Ootacamund at 08 hrs. LMT as well as rainfall records at Mangalore, Calicut, Cochin and Trivandrum during June and July for 1937-40 were analysed for the purpose.

The difference of the barometric pressure between Calicut and Mangalore in the morning at 08.00 hrs. L.T. on a day was noted and the rainfall recorded in the subsequent 24 hours ending at 08.00 hrs. L.T. on the next day at the four reporting stations, was looked into, to find out if one or more of the stations recorded 2" or more of rain. The pressure differences were grouped according to different magnitudes and the number of occasions when 2" or more of rainfall were recorded in each group were found out.

TABLE I

Pressure difference : Calicut—Mangalore									
-100" or more		-090" to -100"		-080" to -090"		-070" to -080"		Below -070"	
a	b	a	b	a	b	a	b	a	b
31	25	31	17	34	20	65	30	83	27

The analysis (Table I) together with the analysis of the pressure at the hill station, Ootacamund, show: (i) when pressure difference between Calicut and Mangalore was less than 0.1", heavy rainfall occurred only on 44% of the days; when the pressure difference was more than 0.1", the percentage was 81; (ii) when the pressure at Ootacamund was 23.015" or less heavy rainfall occurred on 35 out of 45 occasions (i.e., 76%); (iii) when the pressure at Ootacamund was 23.015" or less and the pressure difference between Calicut and Mangalore was .07" or more, heavy rainfall occurred on 85% of the days.

The difference of pressure between Calicut and Ootacamund was also analysed, but this did not seem to be significant, except when it was 6.830" or more, when heavy rainfall occurred on 70% of such occasions.

Thus heavy rainfall in Malabar, South Kanara and Travancore-Cochin areas during June and July can be forecast from the pressure data of the above three stations, (a) when the

$C_{21}H_{30}O_8N_8$ requires N, 17.12). It is interesting to note that neither of (III) and (IV) gave any colouration with alcoholic ferric chloride solution. Details will be published elsewhere.

Dept. of Chemistry,
Panjab University,
Hoshiarpur, May 17, 1956.

V. S. GAIND.
S. M. MUKHERJI.

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5:7 DIBROMO-8 QUINOLINOL COMPLEX OF MOLYBDENUM

MOLYBDENUM is precipitated from solutions of alkali molybdates by the addition of 8-hydroxy quinoline. Precipitation is quantitative¹ from solutions of pH ranging from 3.3 to 7.6. When the precipitate is dried at 130–140°C. it corresponds in composition to the formula $MoO_2(C_9H_6ON)_2$. For extracting rhenium from molybdenite, successive and repeated precipitations of molybdenum with oxine and rhenium as nitron perhenate were suggested.² The separation of molybdenum as oxine complex cannot be very effective as it is pH-sensitive even though it is difficultly soluble in acids and alkalies after drying.³ Hence the 5:7 dibromo-8 quinolinol was tried as a precipitant in the present work. To an aqueous solution of sodium molybdate excess of 1N HCl was added followed by an excess of the reagent solution in 1N HCl. There is an immediate, bulky orange yellow precipitate. Under similar conditions, oxine does not give a precipitate. The filtrate obtained after filtering the precipitate was tested for molybdenum by the standard sulphide, ferrocyanide and reduction tests and was found to be absent. Hence the 5:7 dibromo-8 quinolinol can be used for quantitative separation of molybdenum in the acidic range. The 5:7 diiodo-8 quinolinol was also tried under similar conditions and was found to be not successful.

Recently it was shown⁴ that the dihalo substitution results in the decreased solubility and increased thermal stability of the uranyl complex. The present observation is in conformity with the above. The 5:7 dibromo-8 quinolinol chelate of uranium⁵ was given the formula $UO_2(C_9H_4Br_2NO)_2 \cdot C_9H_4Br_2NOH$, containing an extra molecule of solvation. A systematic investigation was carried out more recently⁶ to ascertain whether the extra solvate molecule can be thermally removed and to

determine the oxide level. Similar investigations are in progress to determine the composition of molybdenum chelate.

Thanks are due to Dr. S. Pani for his helpful criticism.

Dept. of Chemistry, D. V. RAMANA RAO.
Ravenshaw College,
Cuttack, August 1, 1956.

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EARLIER RECORD OF PHALACRUS IMMARGINATUS CHAMPION (COLEOPTERA, PHALACRIDAE)

In his recent note, Agarwal¹ writes that the occurrence of the black beetle, *Phalacrus immarginatus* Champion, on sugarcane smut is presumably the first record. The beetles were collected by him, while feeling the smutted whips of sugarcane at Coimbatore (Madras) in August 1955. In the Entomological Collection at the Forest Research Institute, Dehra Dun, four specimens of this species are present with the following data, indicating its earlier record: Fyzabad, U.P., B. D. Gupta, Coll. 22-3-1946. From smut (*Ustilago scitaminea* Sydow) on sugarcane; G. E. Bryant det.

Again, in May 1946, one specimen collected by B. D. Gupta was received from Biswan, Sitapur (Uttar Pradesh). This species is described by Champion² from five specimens collected in sweeping the grass in April 1923 (H. G. Champion coll.) at Dhauri, Haldwani Division (Uttar Pradesh).

Forest Research Institute, R. N. MATHUR.
Dehra Dun, August 1, 1956.

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ON THE VISCOSITY OF SOLUTIONS IN MIXED SOLVENTS

JONES AND DOLE suggested the equation

$$\eta/\eta_0 = 1 + A\sqrt{C} + BC \quad (1)$$

where η and η_0 are the viscosities of the solution and solvent respectively, C, the concentration of the electrolytes in gram moles per litre, A and B are constants. The equation has been extensively verified for aqueous solution

of electrolytes¹ and an expression has been derived by Falkenhagen and Vernon² for the constant A. The values calculated theoretically for this constant agree well with the experimental values.¹ But no satisfactory explanation of the nature of B has yet been given. Wolfenden and co-workers³ attribute to B an additive character depending on the constituent ions of the electrolyte. Asmus⁴ on the other hand suggests B to be dependent on the lyotropic number and the entropy of hydration of the constituent ions.

We have examined the viscosity of solutions of potassium chloride in mixed solvents of different compositions at $35^\circ \pm 0.005$ with a view to determine the nature of B. Solutions of different concentrations ranging from 0.001 N to 0.1 N with respect to potassium chloride were examined. The accuracy of the period of flow is 0.2 seconds in 20 minutes, i.e., 1 in 6,000. The density measurements are accurate up to 4 in 10^6 . The solvents used were dioxan-water and acetone-water mixtures. The results fit in well with a slightly modified Jones-Dole equation

$$\eta/\eta_0 = 1 + A \sqrt{C} + BC^x \quad (2)$$

where the constants A and B have the same significance as in equation (1). It follows from equation (2) that

$$\log \{\eta/\eta_0 - (1 + A \sqrt{C})\} = \log B + x \log C \quad (2a)$$

The equivalent conductivity at infinite dilution in these mixed solvents were determined by us experimentally. Assuming equal mobility for both K^+ and Cl^- ions and using Åkerlöf's⁵ data for the dielectric constant of the different composition mixtures, the value of A for each of the compositions of the mixed solvents was calculated with the help of the Falkenhagen and Vernon's equation (*loc. cit.*). The calculated values of A and the measured values of the relative viscosity were used in equation (2a). The plot of

$$\log \{\eta/\eta_0 - (1 + A \sqrt{C})\}$$

against $\log C$ would give a straight line, from the intercept and the slope of which the values of B and x can respectively be determined.

TABLE I

% Composition of the (non-aqueous) solvent by weight	Dioxan-water mixture ⁶ $B \times 10^2$	Acetone-water mixture ⁷ $B \times 10^2$
50	12.6	13.8
40	10.0	12.6
30	5.24	6.3
20	3.98	7.9
10	2.00	4.5

It can be seen from Table I that not only is the value of B dependent on the composition of the mixture but also on the nature of the solvent. While Asmus attributes the lyotropic number to be responsible for B, we suggest that it is the nature of the sphere of solvation which determines the magnitude of B. For a single solvent, the solvation sphere is composed of one type of molecule. In case of mixed solvents, it is obvious from the data that the molecules of the constituent components of the solvent contribute to the value of B. We are of opinion that in the sphere of solvation an interaction of the type of an association reaction occurs, between the two species of molecules constituting the solvent.

The work is of interest as it provides a direct proof of the dependence of B on the nature and composition of the solvent hitherto lacking in the field of viscosity.

Dept. of Chemistry,
Ravenshaw College,
Cuttack-3, June 29, 1956.

D. PATNAIK.
P. K. DAS.

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REVIEWS

Practical Solution of Torsional Vibration Problems. (Frequency Calculations.) Vol. I. By W. Ker Wilson. (Chapman & Hall, London), 1956. Pp. xxxii + 704. Price 105 sh.

The rapid development of engineering science has revolutionized the old concept about what an engineer should know. The thumb-rule method of studying engineering has become a thing of the past. Now an engineer must also be a scientist. He must not only be able to use his intuition and the collection of experimental data that he has learnt, but should also be able to handle basic scientific frameworks required to study any natural phenomenon.

Torsional phenomena has been the subject of a large number of scientific investigations. It is of great importance in all engineering design. In particular, its study has saved quite a lot of time and money in the design of internal combustion engines and aero engines and airscrews. The third edition of the book has therefore been completely revised and brought up to date, though it still remains a reference book of collected formulæ and solved examples of a practical nature.

The book has a historical introduction and twelve chapters dealing with frequency calculations of simple system, multi-mass systems, simple and complicated geared systems. The methods described include those of effective inertia, equivalent masses and equivalent shafts. Extensive numerical tables and graphs are given and a good bibliography can help any reader who wants to study the original papers.

The book will prove of invaluable assistance to students interested in solving practical examples and to practising design engineers.

B. R. SETH.

Vacuum Valves in Pulse Technique. By P. A. Neeteson. (Philips Technical Library.) (India: Philips Electrical Co., Ltd., 7, Justice Chandra Madhab Road, Calcutta), 1955. Pp. viii + 170. Price Rs. 12-8-0.

At a time when pulse techniques are becoming extremely important, this book should be most useful to workers in electronics. Although the operation of the tube as a switch is familiar to many, the detailed mathematical treatment of switching phenomena is still not well known. The author of this book tries to give

an indication of the methods of determining the behaviour of a network in which we use electron tubes as switches. The treatment is mostly original and based on the author's own work.

The book is divided into seven main sections and each section is divided into subsections. This is followed by an index. The basic theory of switching and its application to switching circuits come up for preliminary description. This is followed by a treatment of electron tubes as switches. These sections, although brief, are quite clear and useful. There is then a chapter on the Operational Calculus. This could have been conveniently omitted because for those who do not know the subject, it is inadequate. There is then a chapter giving a treatment of the electron tube as a switching element and this is followed by the treatment of a detailed character on the multi-vibrator family. These two chapters are, in the reviewer's opinion, most well done and definitely appear to display a stamp of originality. Those interested in the further development of electronic switching circuits can derive considerable inspiration from these chapters.

The printing and get-up of the book is excellent. It can be strongly recommended as a valuable addition to science and engineering college libraries and should be of real interest to professional men and research workers directly engaged on the problem of switching circuits.

S. V. CHANDRASHEKHAR AIYA.

Fossil Holothurian Sclerites—Monograph. By Don L. Frizzell and Harriet Exline. (Bulletin of University of Missouri, School of Mines and Metallurgy, Rolla, Missouri, U.S.A.) Technical Series No. 89, 1955.

During the past ten years or so micropalaeontology has made phenomenal progress. Prior to this period, Foraminifera, Ostracoda and Conodonts were probably the only groups which received serious attention in the hands of micropalaeontologists and economic palaeontologists.

Recently attempts have been made towards a better understanding and usefulness of other groups of micro-organisms—both plant and animal—such as Radiolarians, Sponge spicules, Diatoms, Spores and pollen, Holothurian

Sclerites, Tintinids, Hystriospherids, etc. We are now on the threshold of a new era in micropalaeontology and applied micropalaeontology. When sufficient advance is made in the study of these hitherto more or less "neglected" organisms micropalaeontologists will have additional "tools" with which to solve their problems of ecology, facies, etc.

A recent contribution in this sphere has been a monograph on fossil Holothurian Sclerites compiled by Don L. Frizzell and Harriet Exline. These sclerites are calcareous bodies forming the major part of the Holothurian skeletal system. They vary in size from 0.05 mm. to about 1.5 mm. and are of different shapes. Some Holothurians may have none of these sclerites, others may have only one kind, and yet others may contribute to a complex variety of sclerites.

The authors have made an extensive study of these sclerites; and in this monograph they deal first with the Holothuroidea giving an excellent account of their biology, classification, ecology, and fossil remains throughout the geologic succession. The Holothuroidea are strictly marine and have never been known living in brackish water, and therefore their remains should prove very useful in applied palaeontology. Except in rare instances, the only fossil remains of the Holothuroidea are the Sclerites and the authors have traced these remains from the earliest known records in the Palaeozoic to the Tertiary and Quaternary. The records of fossil sclerites are mostly confined to Carboniferous—Permian and Jurassic. In the Ordovician a few "sieve plates" have been doubtfully assigned to Holothuroidea. The Triassic again has a poor record as also the Palaeocene, Oligocene and Upper Tertiaries. The Jurassic has by far the best known 'sclerites' remains. It is hoped that this monograph will stimulate further interest in this relatively less known group of organisms.

Y. N.

Common Cultivated Crops of South India. By V. T. Subbiah Mudaliar. [Amudha Nilayam (Private) Ltd., Madras.] Pp. xvi + 606. Price Rs. 15.

The author of this well written book is a retired officer of the Madras Agricultural Department who, with his experience of 30 years spent as an executive officer in the districts of Madras and Andhra and as a Professor in the Agricultural Colleges of the two States, can be expected to do justice to the subject. The book, written in simple, lucid

style, should prove useful to students of agriculture in the schools and colleges of South India, and also appeal to the larger circle of enlightened farmers.

The first four chapters on soil and climate, tillage, manuring and irrigation are intended to give an introduction to the basic aspects of crop husbandry, an understanding of which is essential for getting maximum returns. The other 11 chapters are devoted to a detailed consideration of the agriculture of crops classified according to the nature of the produce obtained. Certain crops have been dealt with in more detail than others on account of their importance or of the diversity in the cultivation practices obtaining in different regions. Special problems of topical interest, like the Japanese method of rice cultivation, have been discussed. Where relevant, the author has also included information on the manufacture into the finished product as in the case of sugarcane and tobacco.

The chapter on green manures should be particularly welcome to cultivators. It explains the purposes and principles behind the practice of green manuring. It is no exaggeration to say that the average farmer in Madras has become green-manure conscious in recent years thanks to the drive of the Agricultural Department. The book abounds in statistical information on acreages and yields, and is illustrated with many neatly executed line drawings and photographs. Appendices pertaining to improved varieties of the more important crops have been given, though one feels that these include at least a few varieties which are obsolete or out of cultivation, and at best have only a historical significance to the student and the cultivator.

One misses accounts of orchard crops and vegetables, plantation crops and others like betel vine and cashew nut which are commonly grown by the cultivator. The inclusion of plant protection measures against the more important pests and diseases will be pertinent in the modern context when many of these have come into general agronomic routine. A few minor errors are evident in the subject-matter, as for example, in the accounts relating to potato and sugarcane but these do not detract from the value of the publication, and the author will no doubt rectify them when called upon to issue a second edition. Certain incorrect or loose terms have been employed, e.g., 'Bacilli called *Bacilli radicolica*' (p. 199), 'yam is a vinous plant' (p. 350), 'sugarcane sets are pickled in copper fungicidal solutions.....' (p. 370). Some errors of spelling attributable

perhaps to defective proof-reading are also seen, e.g., *Zingiber officinalis* (p. 424), *Eriodendron enfructosum* (p. 444), *Grevilla* (p. 444). An index and a more extensive bibliography will enhance the value of this useful publication.

N. L. DUTT.

Trace Elements in Human and Animal Nutrition. By E. J. Underwood. (Academic Press), 1956. Pp. vii + 430. Price \$ 9.50.

While many books on vitamins have been published in recent years, only a few have so far been written on trace elements even though they are as important as vitamins in human and animal nutrition. Monier William's book on 'Trace Elements in Food', published in 1949, is concerned principally with analytical methods and with toxicological and public health aspects of trace elements. The book under review, written by E. J. Underwood of Australia, is perhaps the first of its kind dealing with trace elements from the point of view of their nutritional significance to man and domestic animals and birds.

This publication consists of thirteen chapters and in the introductory chapter, the author has traced the development of the trace element concept from a historical standpoint and has also discussed the mode of action of trace elements and interactions among them. Then the author devotes a chapter each to the following elements: iron, copper, molybdenum, cobalt, nickel, zinc, manganese, iodine, fluorine and selenium. In the last two chapters, the author has dealt with aluminium, arsenic, barium, boron, bromine, silicon, strontium and vanadium and with soil-plant-animal interrelationships. Nutritional aspects have been emphasised throughout, although at various places, the biochemistry, pathology and toxicology of these elements, particularly in relation to animals and birds of economic importance, have been considered in great detail. On the whole it may be said that a balanced treatment of each element has been presented dealing first with the historical background, then the distribution, absorption and excretion together with manifestations of deficiency or toxic symptoms. Also interrelationships between trace elements and their nutritional significance have been stressed at various places. Perhaps, the value of this book could have been enhanced by including briefly details of one method of choice for the determination of each element before giving the data on distribution. The last chapter on soil-plant-animal interrelationship is

very interesting to read and gives much food for thought to the investigators in this field.

The get-up of the book is excellent and though priced high, scientists interested in human and animal nutrition will undoubtedly welcome it as a very valuable publication on trace elements.

P. S. SARMA.

Advances in Carbohydrate Chemistry, Vol. 9. (Academic Press Inc., New York), 1955. Pp. xviii + 426. Price \$ 10.50.

The volume begins with a brief biography of the late Prof. C. S. Hudson who played a very important part in the field of carbohydrate chemistry for nearly fifty years. R. U. Lemieux has given a stimulating account of the application of modern ideas on neighbouring group participation and shapes of organic molecules to replacement reactions encountered in carbohydrate chemistry. The chapter on paper chromatography of carbohydrates and related compounds will be of value not only to sugar chemists but also to biochemists and organic chemists interested in plant products. Chapters on alkali-sensitive glycosides, 2-hydroxyglycal, the raffinose family of oligosaccharides, the methyl ethers of hexuronic acids and the conjugates of D-glucuronic acid are of great value to specialists in the field. The chapters on colour and turbidity of sugar products and on carboxymethylcellulose should interest carbohydrate chemists in industry. Needless to say, Volume 9 maintains the same high standard of scholarship and technical excellence of the earlier volumes.

T. R. GOVINDACHARI.

Qualitative Organic Analysis and Scientific Method. By A. McGookin. (Chapman & Hall, Ltd.), 1955. Pp. vii + 155. Price 15 sh.

The author writes with passionate zeal on organic qualitative analysis, which he believes to be an excellent means of instilling the principles of scientific method into students of chemistry. Since there is no systematised procedure for the analysis of organic compounds, the student has to depend in great measure on his background knowledge of organic chemistry, draw up a plan of work on the basis of initial tests, experiment, observe and come to conclusions. Teachers in charge of qualitative organic analysis know only too well how students go completely off the track as a result of incorrect observation based on some preconceived notion. The author, an experienced teacher, has laid bare the pitfalls encountered in organic analysis and the correct

method of approach in analysing an unknown organic compound. Teachers and students alike will benefit by a perusal of this book. The book, however, is not self-contained since there are no tables of physical constants of organic compounds.

T. R. GOVINDACHARI.

Books Received

Progress in Nuclear Energy, Vol. II. (Reactors). Edited by R. A. Charpie, D. J. Littler, D. T. Hughes and M. Trocheris. (Pergamon Press, London), 1956. Pp. x + 492. Price 100 sh.

An Introduction to Modern Organic Analysis. By Sidney Siggia and Hans J. Stolten. (Interscience Pub.), 1956. Pp. vii + 250. Price \$4.50.

Antibiotics Monographs, No. 6. [Terramycin (Oxytetracycline)]. By Marle M. Musselman. (Interscience Pub.), 1956. Pp. 144. Price \$4.00.

Coimbatore Canes in Cultivation, Second Edition. By N. L. Dutt and J. Thuljaram Rao. (The Indian Central Sugarcane Committee, 20, Rohtak Road, New Delhi), 1956. Pp. 125. Price Rs. 25.

SCIENCE NOTES AND NEWS

Plectropoma maculatum Bloch. in Indian Sea

Dr. (Miss) Mary Chandy, Department of Zoology, University of Delhi, observes that a perch-like fish of the genus *Plectropoma* was caught in March 1948, off the coast of Malwan, south of Bombay, by the Indian Fisheries Company, Ltd., Bombay. It has been identified as *Plectropoma maculatum* Bloch. It measured 577 mm., and is now deposited in the Central Marine Fisheries Collection.

The species has been recorded so far from Malay Archipelago, Red Sea, East Coast of Africa, Ceylon, China, Japan and Australia (Weber & de Beaufort, *Fish. Indo-Austral. Archip.*, 1931, 7, p. 77). Its appearance in the Arabian Sea is recorded for the first time, indicating that its range of distribution extends to the West Coast of India also.

Experiments with Weightlessness

The effects of being without weight for a prolonged period cannot be determined until man actually goes out into space. But Dr. S. J. Gerathewohl, of the United States School of Aviation Medicine, has been able to produce weightlessness in the occupants of an aircraft for periods of up to 45 seconds.

After a preliminary dive to gain speed, a Lockheed T-33 was made to follow a parabolic arc such as would be described by a stone flung to a height of 20,000 feet using at the same time just enough engine power to overcome air resistance. The same pilot flew throughout the experiment, and 16 subjects, all with previous flying experience, were taken up in turn as passengers, each for several flights, usually held in by harness but sometimes letting them-

selfs float free. All were asked to record their sensations. Surprisingly enough at least half the subjects found the sensation enjoyable; as one of them put it: "I've never been so comfortable in all my life, and I think that if I had my choice of places to relax, a weightless condition would be definitely it."

Another group found the sensations merely tolerable, while a quarter of the whole number suffered from motion sickness. No one can be certain that these findings would still apply if weightlessness were extended to longer periods, but it is interesting to learn that it is not a distressing condition to many.

International Cloud Atlas

The World Meteorological Organisation announces that the various volumes of the *International Cloud Atlas* are nearing completion and will be available shortly for distribution. Volume I (price \$2.35) is a comprehensive text containing a detailed descriptive study of clouds and meteors, and of the techniques of observing and reporting them, both by surface and by air-borne observers. Volume II (price \$4.45) is a collection of 224 plates, 121 in black and white and 103 in colour, the object of which is to illustrate the text of Volume I. These photographs, some taken from the earth's surface and some from aircraft, depict many different kinds of clouds and certain of the atmospheric meteors. Each plate contains a legend which describes the important features in the photograph and explains how to identify and code the clouds represented. The volume concludes with two appendices designed to assist the reader in finding a particular illustration speedily.

An abridged edition of the *International Cloud Atlas*, an album specially intended for the use of pilots and air-borne observers, and bare plates for the benefit of meteorological services and others also will also be available.

XIVth International Conference on Tuberculosis

The XIVth International Conference on Tuberculosis under the auspices of the International Union against Tuberculosis and the Tuberculosis Association of India will be held in New Delhi from the 7th to 11th January 1957. This will be the first International Congress on Tuberculosis to be held in the East.

The principal questions to be discussed during the Conference are: Diagnostic and biological problems of isoniazid-resistant tubercle bacilli; clinical and epidemiological results of ambulatory chemotherapy in pulmonary tuberculosis; and the incidence of tuberculosis in economically under-developed countries and the methods for evaluating it.

Symposia on the following subjects have been arranged: value of tuberculin reactions for the selection of cases for B.C.G. vaccination and significance of post-vaccination allergy; the importance of nutritional factors in tuberculosis; cortisone in the treatment of tuberculosis; and the role of voluntary tuberculosis associations in tuberculosis control programmes.

Magnetic Crystals by Hydrothermal Method

According to a report by the Office of Technical Services, U.S. Department of Commerce, magnetite crystals have been successfully grown at a rate of 0.05 millimetre per day by a hydrothermal process. Growth occurred in steel autoclaves containing ammonium chloride solution. Temperature at the top of the chamber, where the crystals grew, was 430° C. and at the bottom 480° C. Pressure was about 22,500 pounds per square inch. Growth rate decreased with lower temperatures and pressures and practically stopped at about 400° C. and 15,000 pounds per square inch.

Among various aqueous media used, only ammonium chloride promoted crystal growth through a hydrogen-producing reaction to steel alloys in the pressure vessels. The specific function of the solution is not yet clear. Evidence showed that the growth was the outcome of a chemical process, and not of recrystallisation of the parent material from a supersaturated solution. Although experimentation was primarily with magnetite, it is believed that the

process may be applied to production of other ferrites.

Role of History of Science

The Indian Society for the History of Science is organising a symposium on the role of history of science at the forthcoming session of the Indian Science Congress Association at Calcutta. The following have agreed to participate, and read the papers on the subject noted against their names: Dr. D. S. Kothari—Value of History of Science in General Education; Professor R. C. Mazumdar—Role of the History of Science in the Study of Ancient Culture; Professor P. Ray—Teaching of Chemistry on the Historical Background; Professor S. N. Hassan—Role of the History of Science in the Teaching of History.

Those desirous of participating may communicate the title of their paper and a brief abstract, not more than 400 words to the Secretary: Dr. A. Rahman, Regional Research Laboratory, Hyderabad-9.

Storing Molecular Fragments

The National Bureau of Standards has developed a technique for capturing and storing large numbers of highly reactive molecular fragments at temperatures near absolute zero. In this method, unstable atoms and free radicals, known to exist but momentarily in flames and hot gases, are produced in an electric discharge, frozen into immobility, and trapped in solid form. Because these atoms are frozen in the excited state, they can be conveniently studied by optical spectroscopy.

In experiments to date, the Bureau has produced solids containing atomic nitrogen and oxygen, and possibly atomic hydrogen and an unstable hydroxy (OH) molecule. These solids have very unusual properties, emitting bright glows, blue "flames", and coloured flashes of light. When warmed 20° or 30°, they combine very actively, releasing large quantities of stored energy, principally as heat. Possible fields of application for this new method include studies in solid state physics and basic chemistry, in which the trapped atoms could be used as powerful probes into the solids containing them.

University Research in the Soviet Union

The role of Universities in research in the Soviet Union is undergoing a major change, according to the *New York Times*. The Soviet Government has ordered the transfer of a number of research institutions from the control

of the Soviet Academy of Sciences to that of the Universities. The Ministry of Higher Education, which controls the Universities, will compile a plan that will stipulate the most important areas for research. It is expected that Universities will work on automation of production, development of semi-conductors, the application of oxygen to metallurgy, the chemistry of radioactive substances, nuclear physics, machine tool design, the increase of crop yields and so on.

List of Indian Fungi

A List of Indian Fungi: 1952-56, by C. V. Subramanian and K. Ramakrishnan, has just been published in *J. Madras Univ.*, B, 1956, 26, 327. This list brings together records of Indian fungi including new taxa proposed during the period 1952-56 and follows the same format of the authors' previous list (*J. Madras Univ.*, B, 1952, 22, 163), which covered the period, 1938-52. Following a brief resume of the Indian work during the period, the fungi are listed alphabetically under genera, together with full citation of literature. A list of host genera and substrata, a list of basonyms of the fungi listed as well as some obligate and facultative synonyms, and a systematic arrangement of the genera are appended.

Botanical Research Institute in Kashmir

The Government of Jammu and Kashmir have set up an organization for pathological survey and botanical research in the State. The scheme which forms part of the State's Second Five-Year Plan, includes survey of and investigation into diseases of forest trees, decay of timber and forest fungi; diseases of fruit and avenue trees; diseases of crop plants; and die-back of mulberry trees in the plantations in the State.

The Scheme also provides for organization of botanical studies, research and expansion in co-ordination with the University of Jammu and Kashmir, and envisages the establishment in Srinagar of a National Park or Botanical Garden and Arboretum representing economic plants of Western Himalayas and of the State; a Botanical Museum; and a Herbarium representing the flora of North and North-Western India to facilitate the study of plant science in the Jammu and Kashmir University.

The Botanical Research Institute will conduct surveys and investigations in co-ordination with the Forest, Agriculture and Seri-

culture Departments. Dr. K. Bagchee, ex-mycologist, Forest Research Institute, Dehra Dun, has been appointed Director, Botanical Research, Jammu and Kashmir.

The Corday-Morgan Commonwealth Fellowship

Applications are being invited from citizens of any country within the British Commonwealth for The Corday-Morgan Commonwealth Fellowship for Post-Doctorate (or equivalent) study in any branch of Chemistry. It will be tenable for one year in some part of the British Commonwealth other than that in which the candidate received his scientific education, at any University, research institution, or other place of study approved by the Corday-Morgan Memorial Fund Executive.

The value of the Fellowship will be £ 700 per annum, but additional allowances may be granted in appropriate cases for travel, University fees, etc. The appointment will date from the 1st October 1957, or such other date as may be arranged.

Application forms and copies of the General Regulations governing the Award may be obtained from: The Secretary, Corday-Morgan Memorial Fund Executive, C/o The Chemical Society, Burlington House, London, W.1. Applications must be received by the Secretary not later than 1st March 1957.

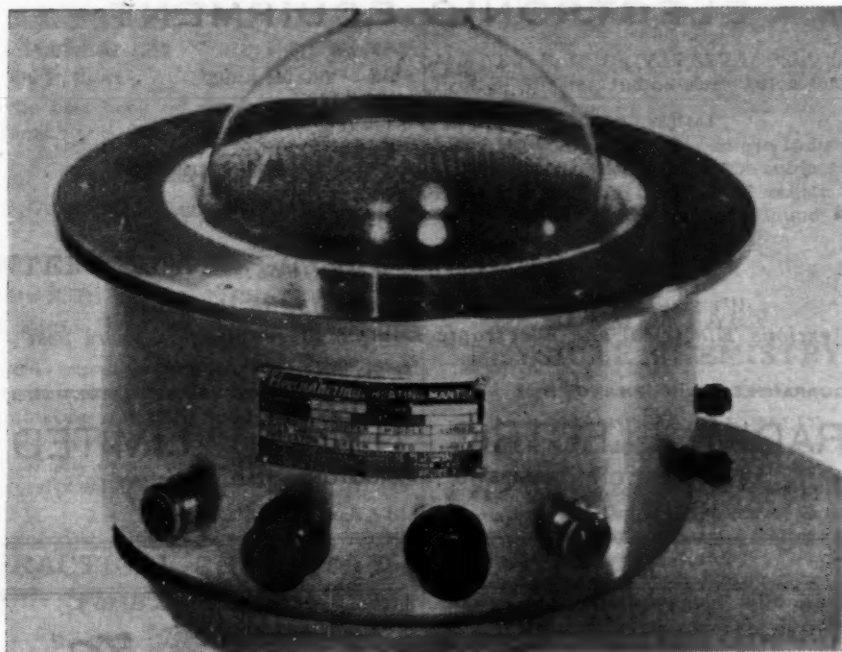
Award of Research Degree

The Andhra University has awarded the D.Sc. Degree in Geophysics to Sri. A. A. Rama Sastry for his thesis entitled, "Some Aspects of the Physics of the Atmosphere and the Sea; and the D.Sc. Degree in Chemistry to Sri. V. Panduranga Rao for his thesis entitled, "Photochemical Analysis: Newer Methods for the Estimation of Uranium."

The Annamalai University has awarded the Ph.D. Degree in Chemistry to Kumari A. A. Aleykutty for her thesis entitled, "Preparation of Sulphones by the Fries and Friedel-Crafts Reactions and a Spectroscopic Study of the Internal Hydrogen Bond in o-Hydroxy Sulphones."

The Osmania University has awarded the Ph.D. Degree in Physics to Messrs. K. Ramavataram, V. T. Deshpande and T. S. Narasimhamurthy for theses entitled, "Studies in Chelation by Raman Effect", "X-Ray Studies of Temperature Variation of Lattice and the Coefficients of Thermal Expansion", and "Photo-elasticity of Crystals" respectively.

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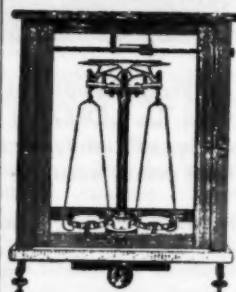
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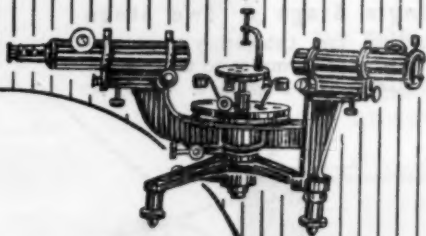
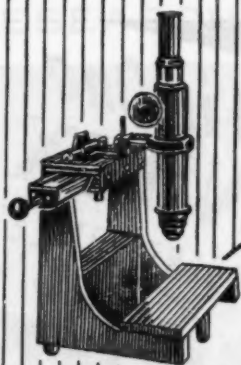
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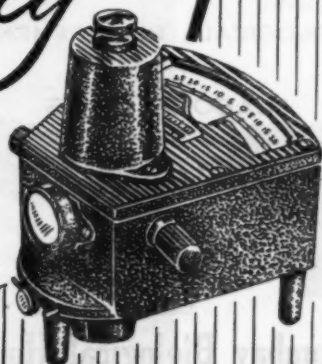
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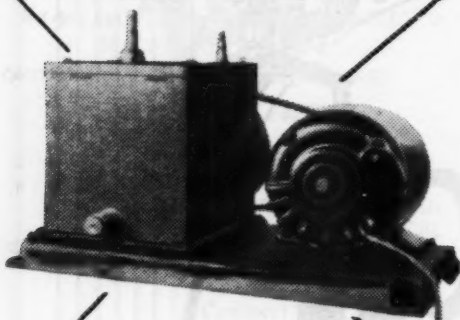
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